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# **The Hazard of Exposure to 2.075 kHz Center Frequency Narrow Band Impulses**

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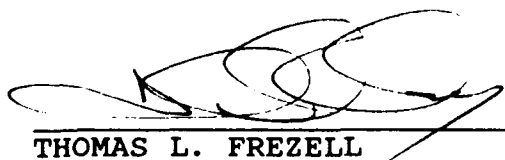
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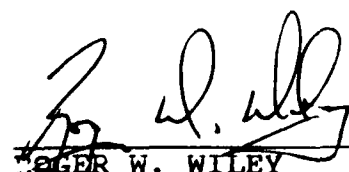
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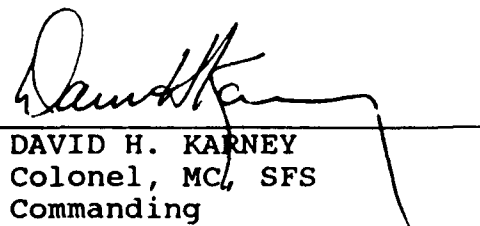


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## Introduction

One of the major problems associated with existing criteria for exposure to high levels of impulse noise is the total lack of specific attention that is paid to the energy spectrum of the impulse. Virtually all criteria focus on the trading relation between intensity and time or some measure of total energy. Since the auditory system processes an acoustic stimulus in a frequency specific manner, a criterion for exposure to transients should reflect the frequency specific characteristics of the auditory system and how those characteristics are related to susceptibility to impulse noise trauma. An earlier report by Patterson et al., (1991) showed that a frequency weighting function for transients could be derived. This weighting function was based upon audiometric and histological data gathered from 118 chinchillas exposed to a variety of narrow band (frequency specific) impulses at various peak intensities. The weighting function clearly demonstrates that equivalent amounts of impulsive energy concentrated at different frequencies are not equally hazardous to the auditory system. Since the weighting function was obtained using narrow band tone pips as the exposure stimulus, it was important to determine the extent to which this weighting function could be applied to actual high intensity blast wave stimuli. A large body of audiometric data (Patterson and Hamernik, 1991), obtained from chinchillas exposed to three spectrally different blast waves, was analyzed using an approach that related the 90th percentile group mean PTS averaged at 1, 2 and 4 kHz to the P-weighted sound exposure level (SEL) of the blast wave exposure. Details of this specific analysis can be found in Patterson and Hamernik, (1991). The results of the analysis indicated that the appropriate weighting function was similar to the P-weighting function at all frequencies for which data were available except in the vicinity of 2 kHz where there was an approximate 10 dB discrepancy as shown in Figure 1. To resolve this discrepancy, two additional groups of animals were exposed to narrow band impulses with a center frequency (CF) of 2.075 kHz, and peak intensity of 134 dB or 139 dB. This report presents the results obtained from these two additional groups.

## Methods and procedures

The methods and experimental paradigm were identical to those presented in Patterson et al., (1991) and thus will not be repeated in detail here. Basically, an avoidance conditioning paradigm was used to obtain pre- and postexposure threshold measurement at 10 audiometric test frequencies between 0.125 and 8 kHz. Thresholds were followed after exposure at regular intervals over a period of 30 days, at

which time the animals were sacrificed for surface preparation histology. Each animal was individually exposed at a normal angle of incidence to one of the two exposure conditions shown in Table 1. The exposures consisted of the presentation of 100 narrow band impulses at the rate of 1 per 3 seconds. Each experimental group consisted of six animals. The impulses were computer generated and transduced to an acoustic stimulus as in Patterson et al. (1991). The pressure-time history and energy spectra of the narrow band stimulus used are shown in Figure 2. From the pressure-time history of the impulsive stimulus, the integral of pressure squared over time was computed to obtain the total sound exposure level (SEL) re: 20m Pa sec for each exposure condition (Table 1).

### Results and discussion

The mean preexposure audiogram for the 12 animals used in these experiments along with the normative data of Miller (1970) is shown in Figure 3. The group mean thresholds for the two groups are shown in Table 2. A two-way analysis of variance showed that there was no statistically significant difference in the thresholds between the two groups. For each animal threshold shifts (TS) were computed by subtracting that animal's preexposure threshold from the postexposure threshold at each audiometric test frequency. The audiometric effects of each exposure were documented in three ways:

(1) The mean threshold shift recovery functions for each group and each test frequency (Figures 4 through 13).

(2) The maximum TS for each group and for each test frequency (Figure 14).

(3) The permanent threshold shift (PTS) for each group and for each test frequency (Figure 15).

Bars represent the standard error of the mean. If no bar is present, the standard error was less than the size of the symbol.

All three of the above sets of audiometric data were consistent in showing that the higher intensity stimulus produced the more severe threshold shifts. All individual animal thresholds and group mean thresholds are summarized in the appendix.

The group mean inner and outer hair cell losses are shown in Figure 16. As seen in the audiometric data, the more intense stimulus caused a greater loss; however, unlike the audiometric data, there is a clear frequency effect in the

Table 1

Definition of experimental groups.

Group	N	Center frequency (Hz)	Peak SPL (dB)	Total SEL (dB)
1	6	2075	134	124.5
2	6	2075	139	129.3
Total	12			

Table 2

Preexposure threshold means (dB) and standard deviations  
for all groups compared to published forms.

		Test frequency (Hz)										
Group	N	125	250	500	1000	1400	2000	2800	4000	5700	8000	
1	6	16.5	9.7	2.8	-1.2	-1.2	-2.2	0.3	-0.5	4.7	3.2	$\bar{X}$
		3.7	1.6	3.2	2.0	3.0	2.3	3.3	3.0	2.8	4.2	s
2	6	17.2	8.0	1.7	1.8	0.7	-0.2	0.8	1.0	0.8	1.5	$\bar{X}$
		5.7	5.1	3.5	3.8	3.3	2.7	3.6	5.3	3.4	1.8	s
Total	12	16.8	8.8	2.3	0.3	-0.3	-1.2	0.6	0.3	2.8	2.3	$\bar{X}$
		4.6	3.7	3.3	3.3	3.1	2.6	3.3	4.2	3.6	3.2	s
Miller (1970)		19.9	8.8	5.1	3.0	2.2	2.7	-0.2	1.9	1.9	5.8	$\bar{X}$
		5.4	3.9	6.1	4.1	6.6	4.7	4.9	7.1	6.7	5.4	s
		36	36	36	36	34	36	35	36	35	36	N

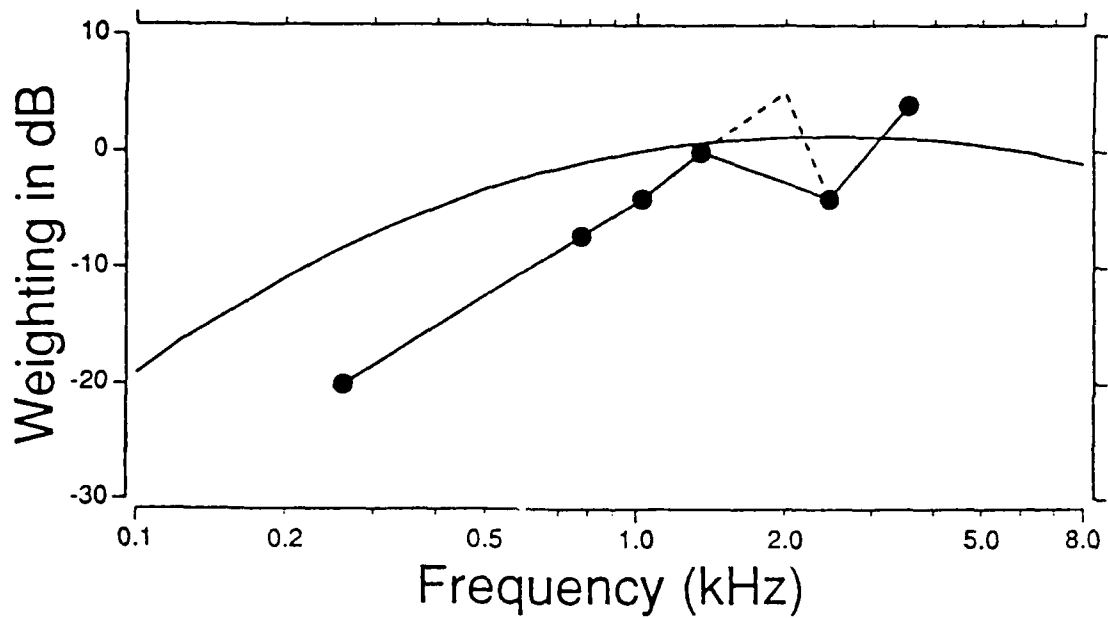


Figure 1. The empirical P-weighting function from Patterson et al. (1991) (filled symbols) along with the conventional A-weighting function (solid line) and the weighting function inferred from the blast wave data of Patterson and Hamernik (1991) (dotted line).

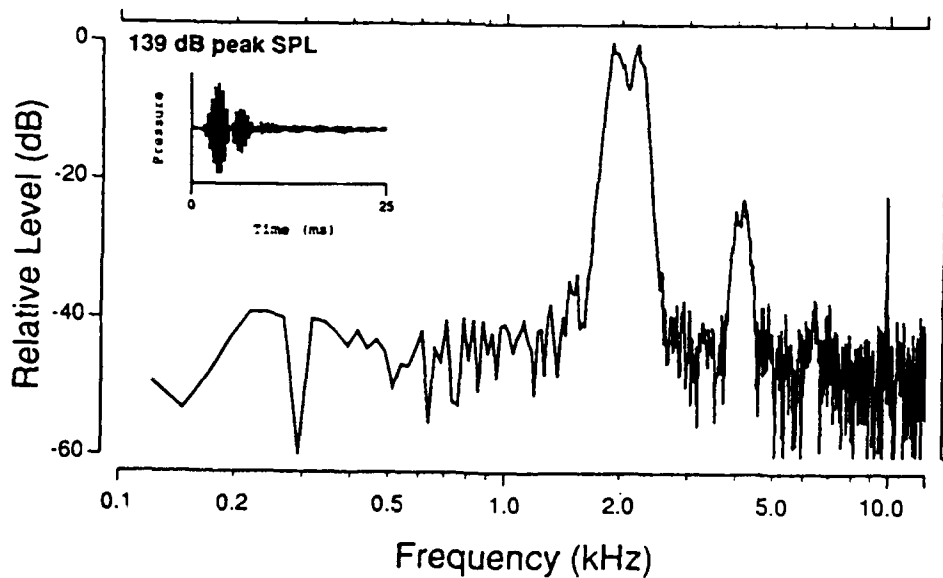


Figure 2. The narrow band impulse pressure-time waveform (inset) and the relative frequency spectrum of the impulse for the 2.075 kHz CF, 139 dB peak SPL stimulus.

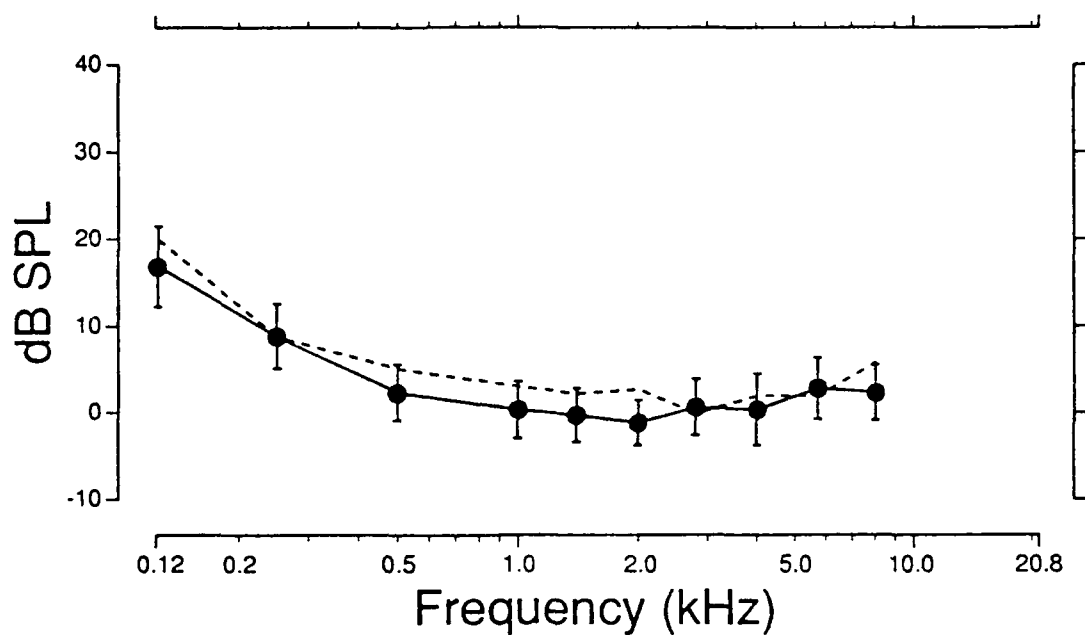


Figure 3. The mean preexposure audiogram for all 12 chinchillas (symbols) compared to that of Miller (1970) (dashed line). The error bars represent one standard deviation above and below the plotted point.

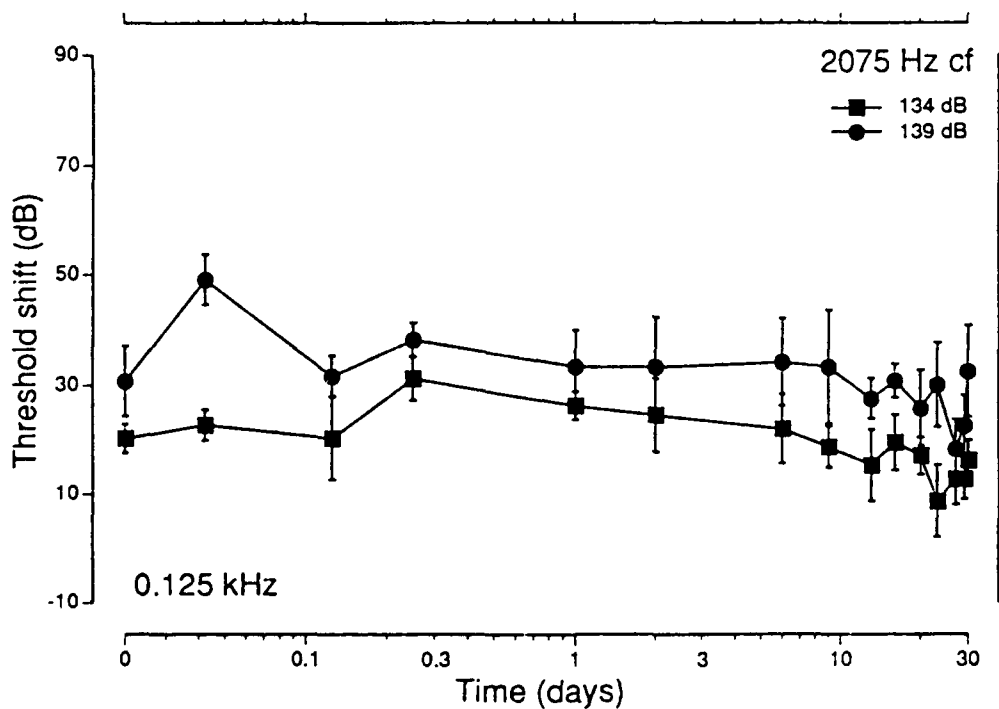


Figure 4. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 0.125 kHz audiometric test frequency.

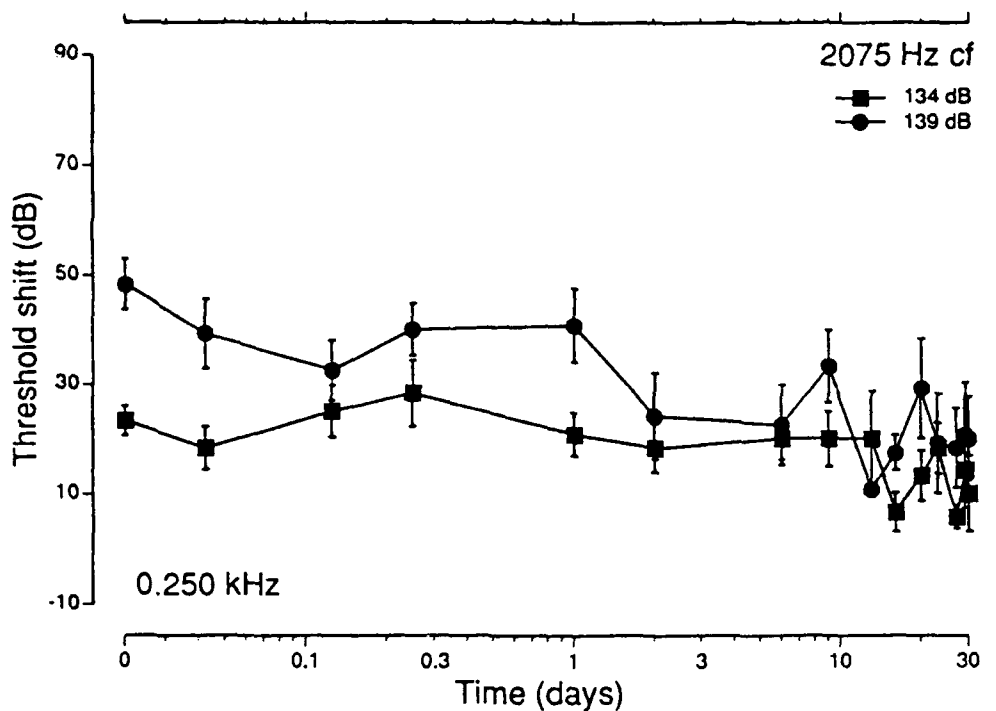


Figure 5. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 0.250 kHz audiometric test frequency.

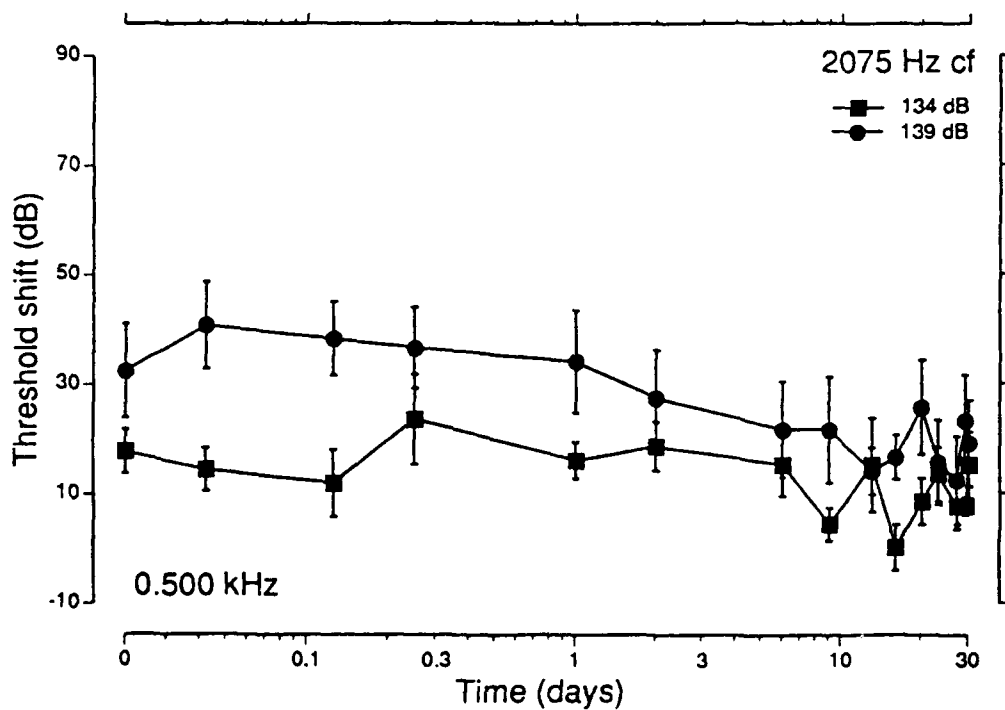


Figure 6. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 0.500 kHz audiometric test frequency.

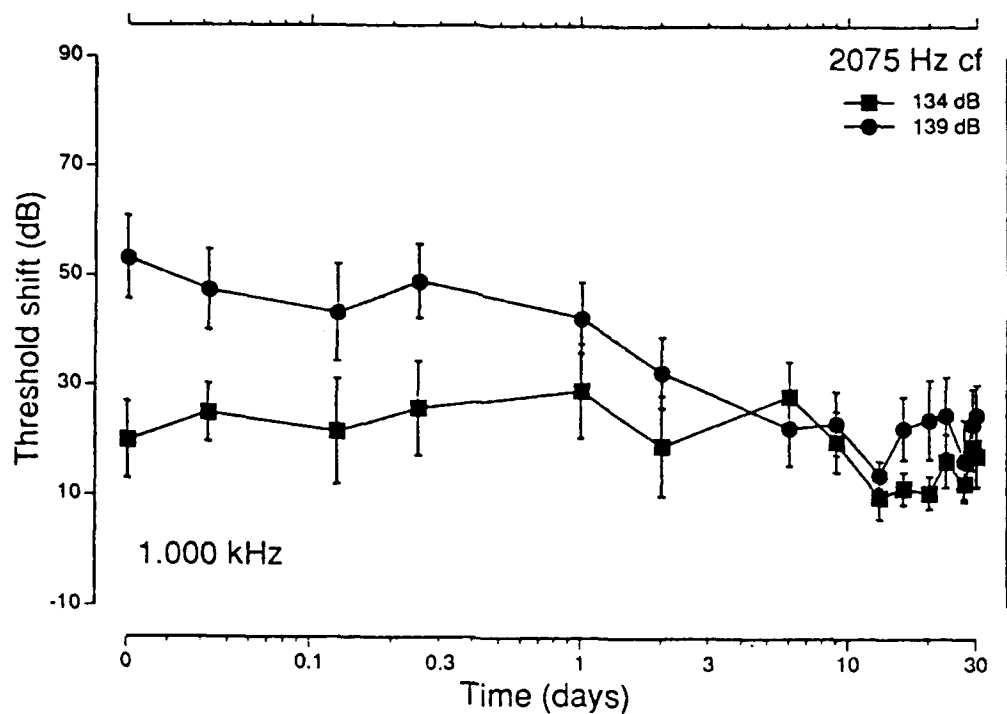


Figure 7. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 1.000 kHz audiometric test frequency.

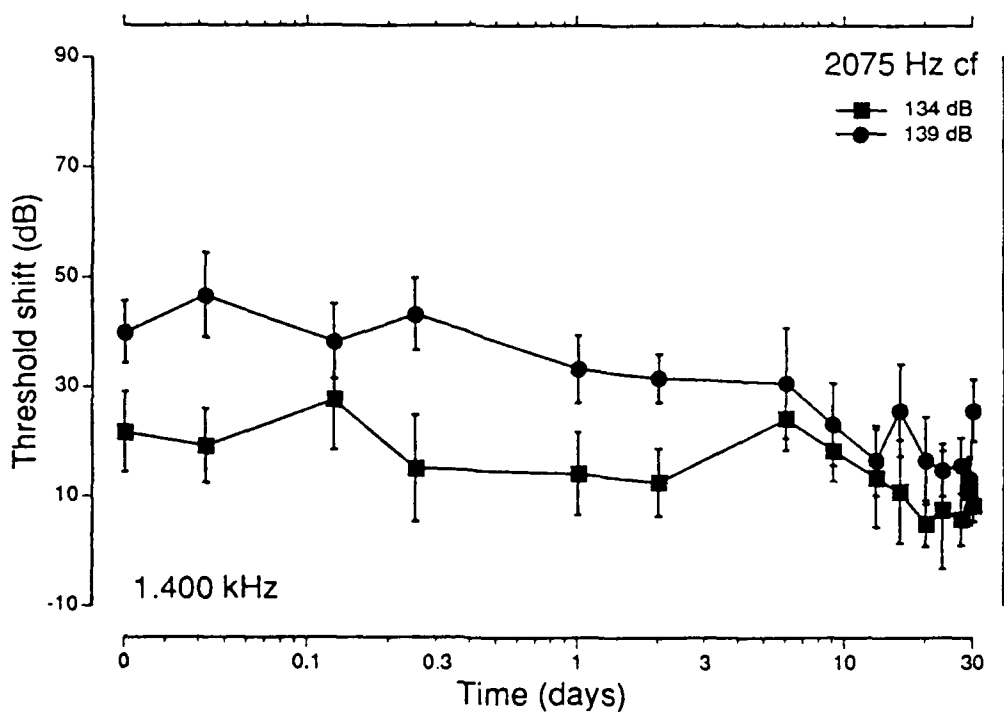


Figure 8. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 1.400 kHz audiometric test frequency.



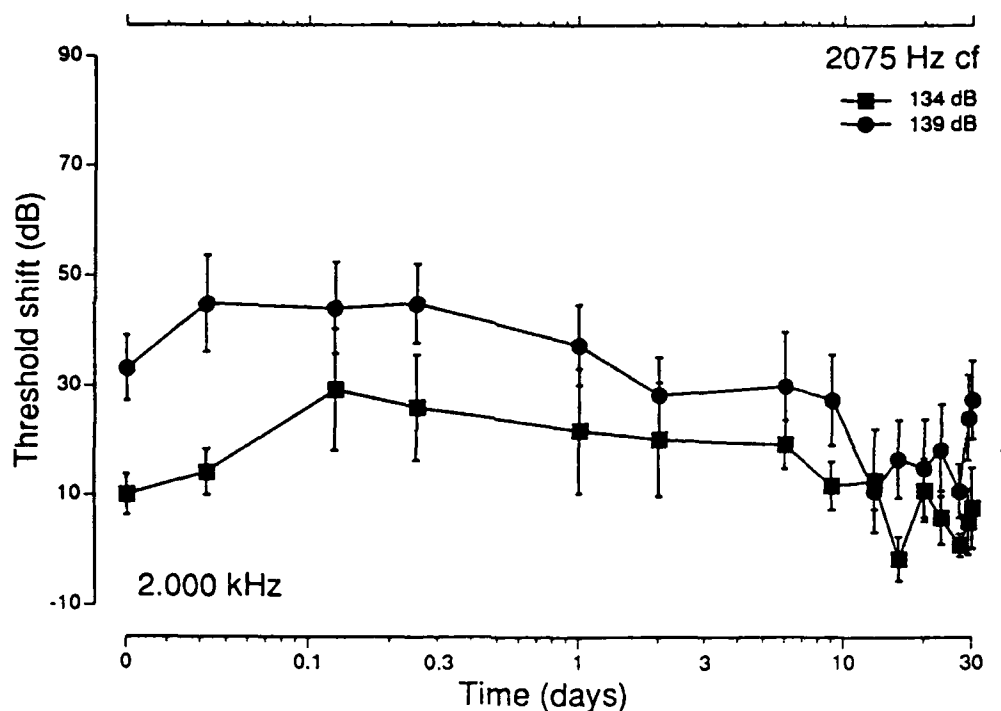


Figure 9. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 2.000 kHz audiometric test frequency.

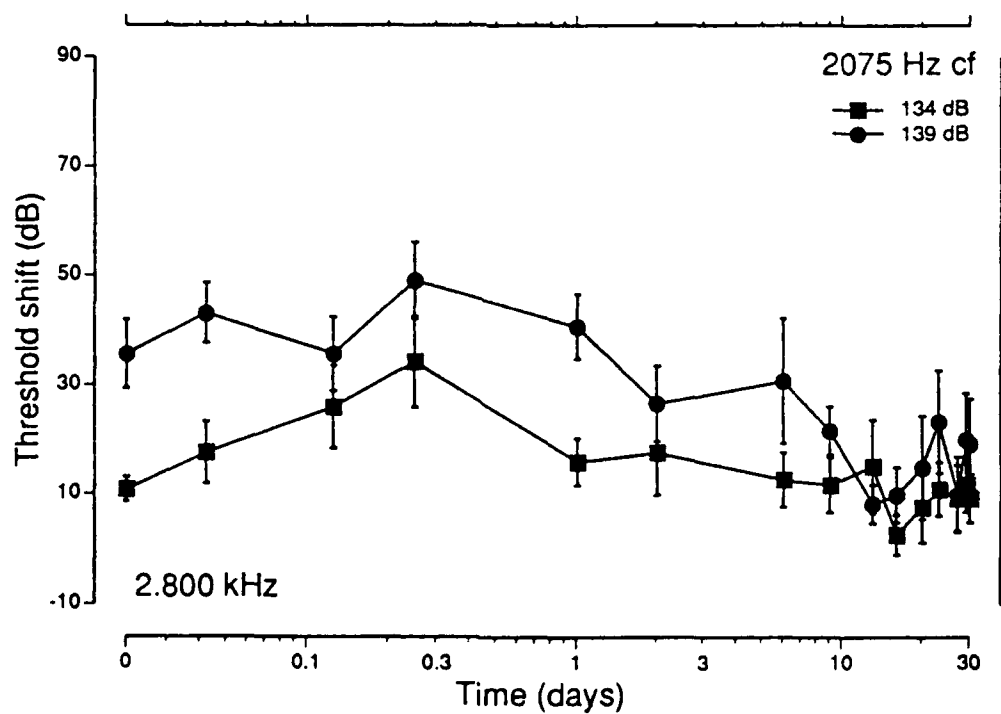


Figure 10. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 2.800 kHz audiometric test frequency.

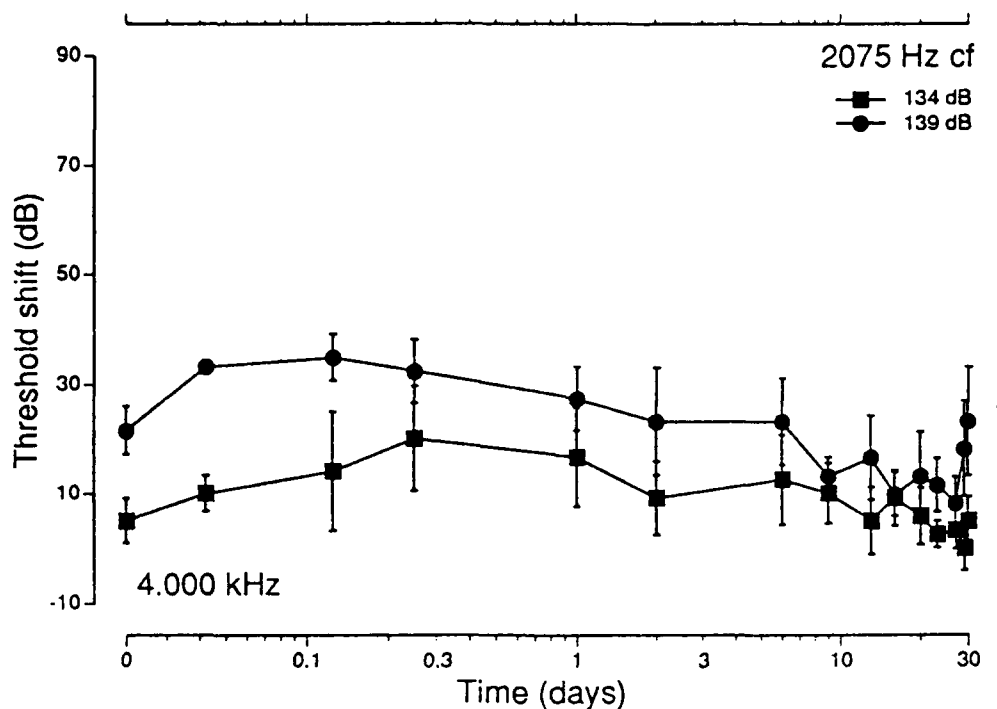


Figure 11. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 4.000 kHz audiometric test frequency.

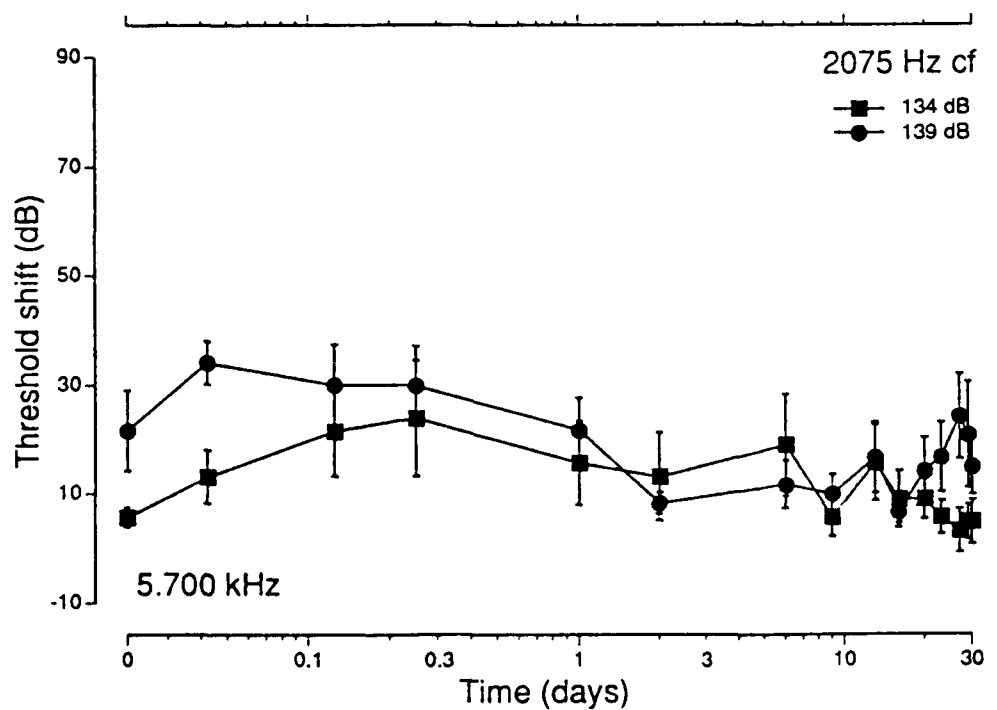


Figure 12. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 5.700 kHz audiometric test frequency.

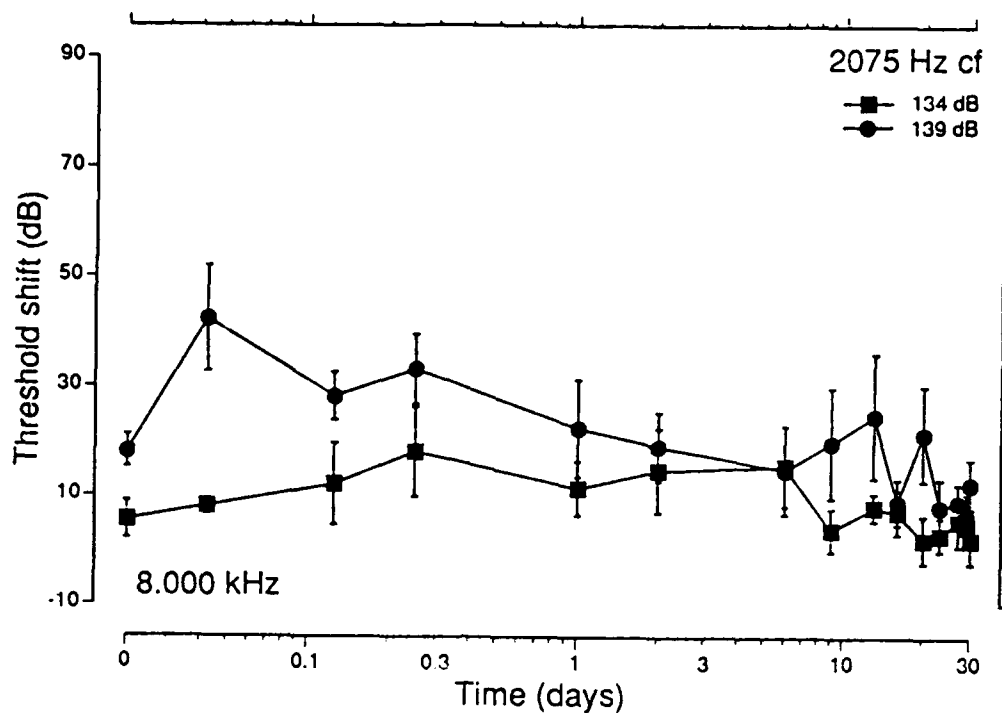


Figure 13. The mean threshold recovery curves for the groups exposed to the 2.075 kHz CF impulse at the indicated peak SPL for the 8.000 kHz audiometric test frequency.

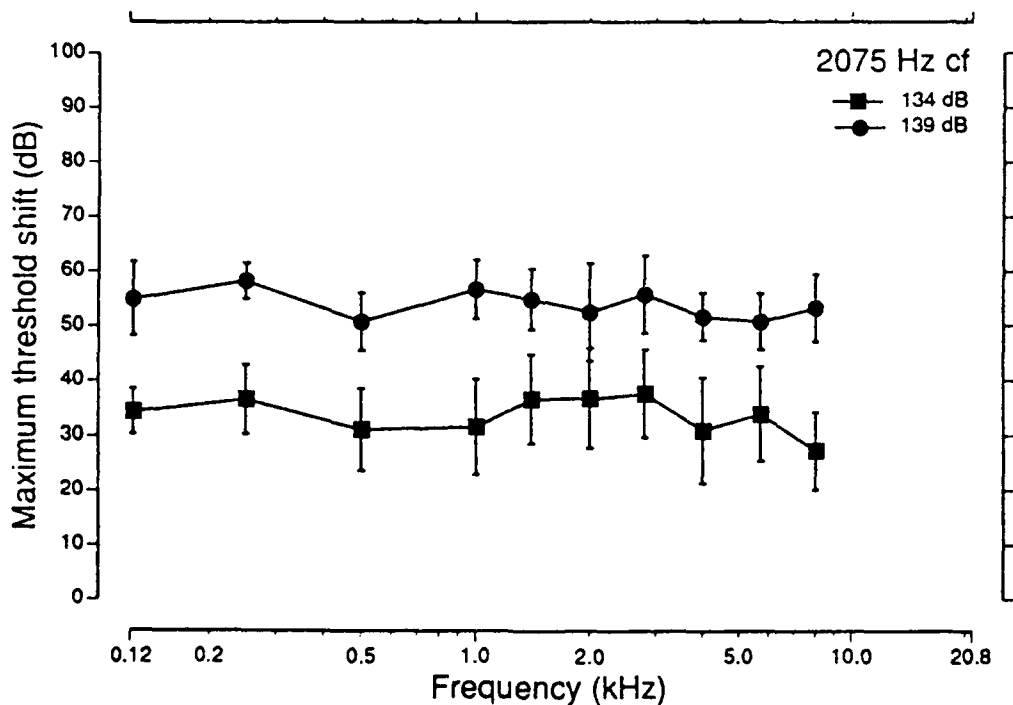


Figure 14. The group mean maximum threshold shift for each audiometric test frequency following exposure to the 2.075 kHz CF impulse at the indicated peak SPL.

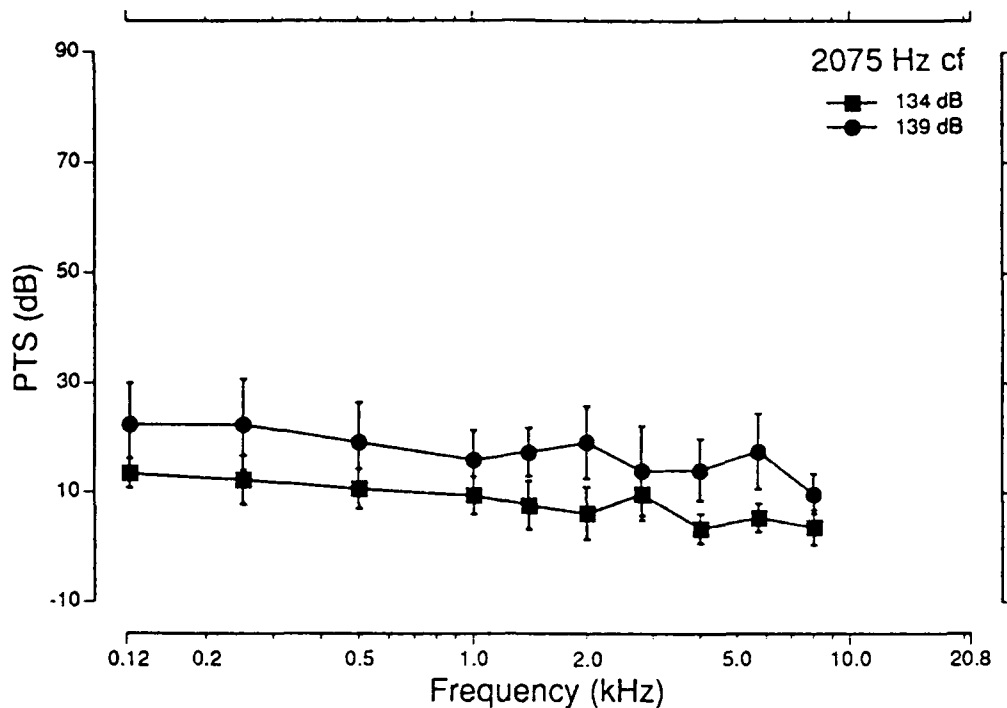


Figure 15. The group mean permanent threshold shift for each audiometric test frequency following exposure to the 2.075 kHz CF impulse at the indicated peak SPL.

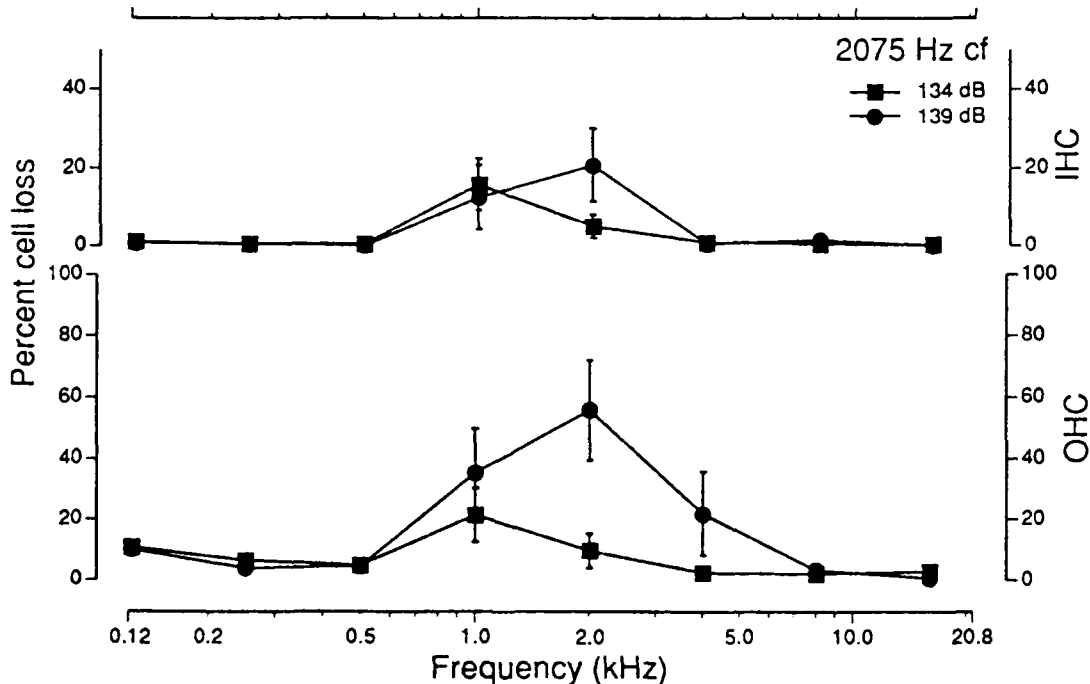


Figure 16. The group mean outer hair cell (OHC) loss and inner hair cell (IHC) loss within octave band lengths of the basilar membrane at the indicated frequencies following exposure to the 2.075 kHz CF impulse at the indicated peak SPL.

sensory cell loss data. The 139-dB peak SPL impulse produced a well defined lesion in the 2 kHz region of the cochlea, while the lesion produced by the 134 dB impulse was located near the 1-kHz region. For each animal, cochleograms which quantify the sensory population of the noise damaged cochlea are also shown in the appendix along with group mean sensory cell loss data.

Following the analysis procedures used in Patterson et al., (1991), these data were incorporated into the P-weighting function. Figure 17 shows the group mean PTS measured at 1, 2 and 4 kHz ( $PTS^{1,2,4}$ ) for the two groups of animals exposed to the 2.075 kHz impulse plotted as a function of total SEL along with the data from Patterson et al., (1991), which were used to derive the P-weighting function. The results of this data reduction for the 2.075 kHz impulse are very similar to those of the 1.025 kHz impulse. The effect of shifting these data along the SEL axis, the amount necessary to collapse the data into a single PTS versus SEL function using the 1.350-kHz series of data as the reference point is shown in Figure 18. The amounts shifted were: 0.260 kHz CF impulses, -20 dB; 0.775 kHz CF impulses, -7.2 dB; 1.025 kHz CF impulses, -4 dB; 1.350 kHz CF impulses, 0 dB; 2.075 kHz CF impulses, -4 dB; 2.450 kHz CF impulses, -4 dB and 3.550 kHz impulses, +4 dB. The relative frequency weighting function derived from the shift of the data shown in Figure 17 is shown in Figure 19.

Figure 20 shows the total group mean sensory cell loss data for the 2.075 kHz impulse as a function of the total SEL along with the Patterson et al., (1991), data. Applying P-weighting function shown in Figure 19 to the sensory cell data produces the realignment of these data seen in Figure 21 thus reinforcing the validity of the weighting function. A regression line through these sensory cell data yields a correlation coefficient of 0.849 and 0.841 for the outer hair cell and inner hair cell losses respectively.

### Conclusions

Both the audiometric and the histological results indicate that the general shape of the P-weighting function proposed in the Patterson et al., (1991), document, in the vicinity of 2 kHz, is appropriate for narrow band impulse exposures. Thus, the inconsistency seen in the 2-kHz region when P-weighting is applied to blast wave transients cannot be explained on the basis of the proposed shape of the P-weighting function. The apparent differences between the narrow based impulses and the blast wave data still need to be resolved.

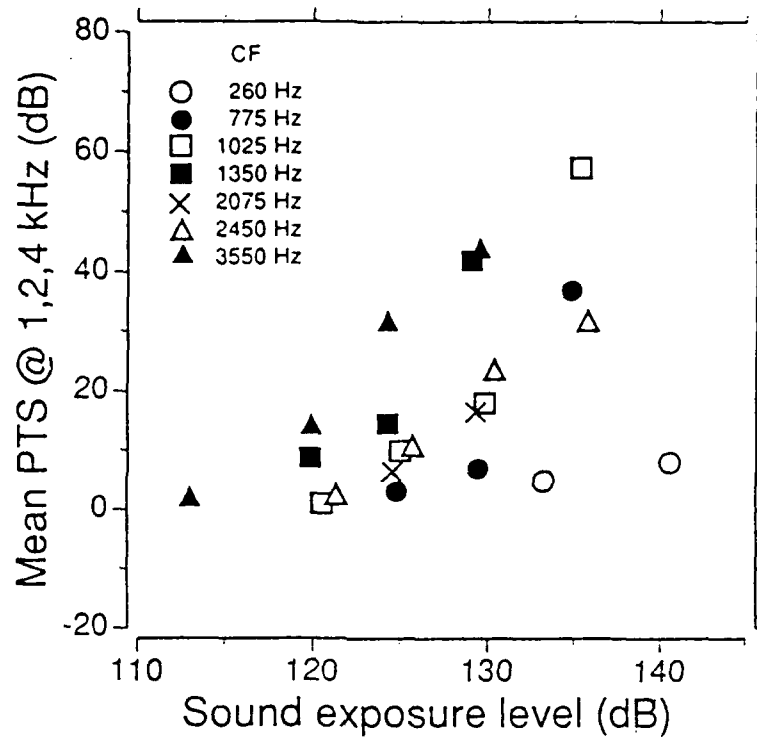


Figure 17. The group mean PTS evaluated at 1, 2 and 4 kHz ( $PTS_{1,2,4}$ ) as a function of the total sound-exposure level for 22 groups of animals exposed to various narrow band impulses.

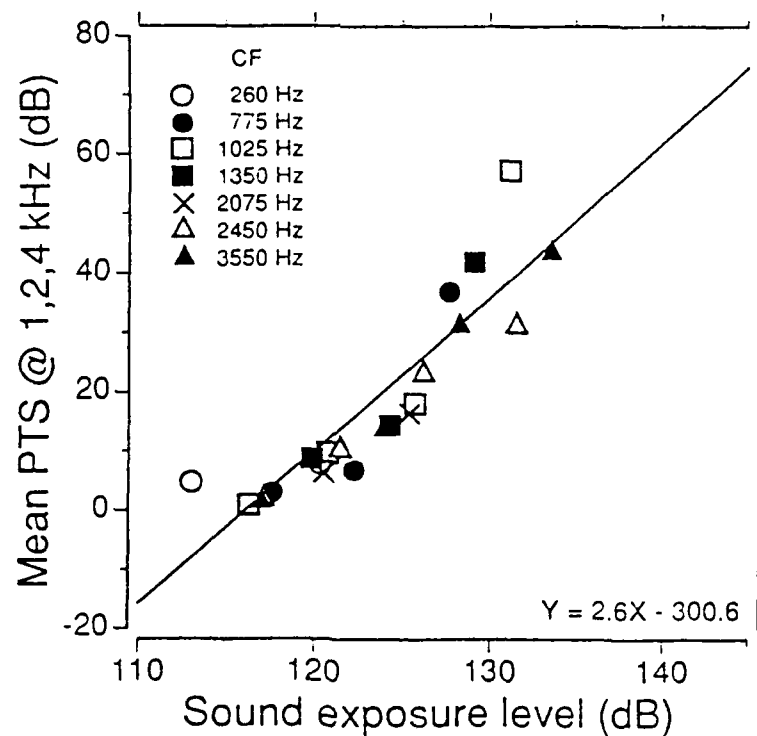


Figure 18. The  $PTS_{1,2,4}$  as a function of the P-weighted total sound exposure level. The regression line yields a correlation coefficient of 0.898.

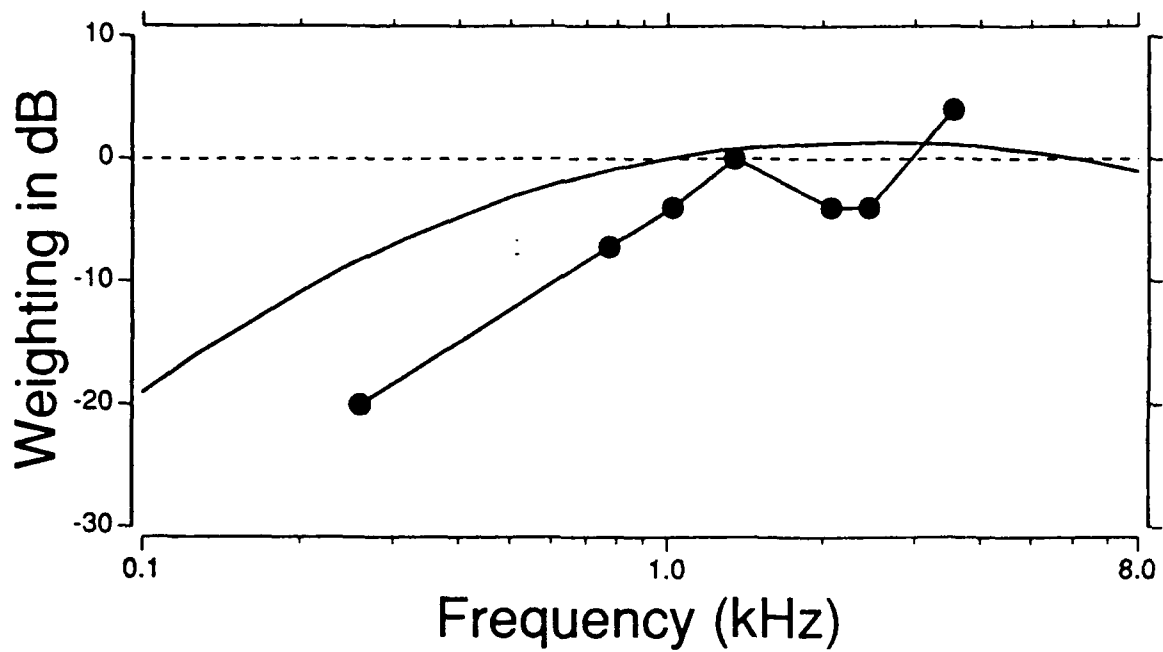


Figure 19. The empirical P-weighting function (symbols) derived from the narrow band exposure data along with the conventional A-weighting function (solid line).

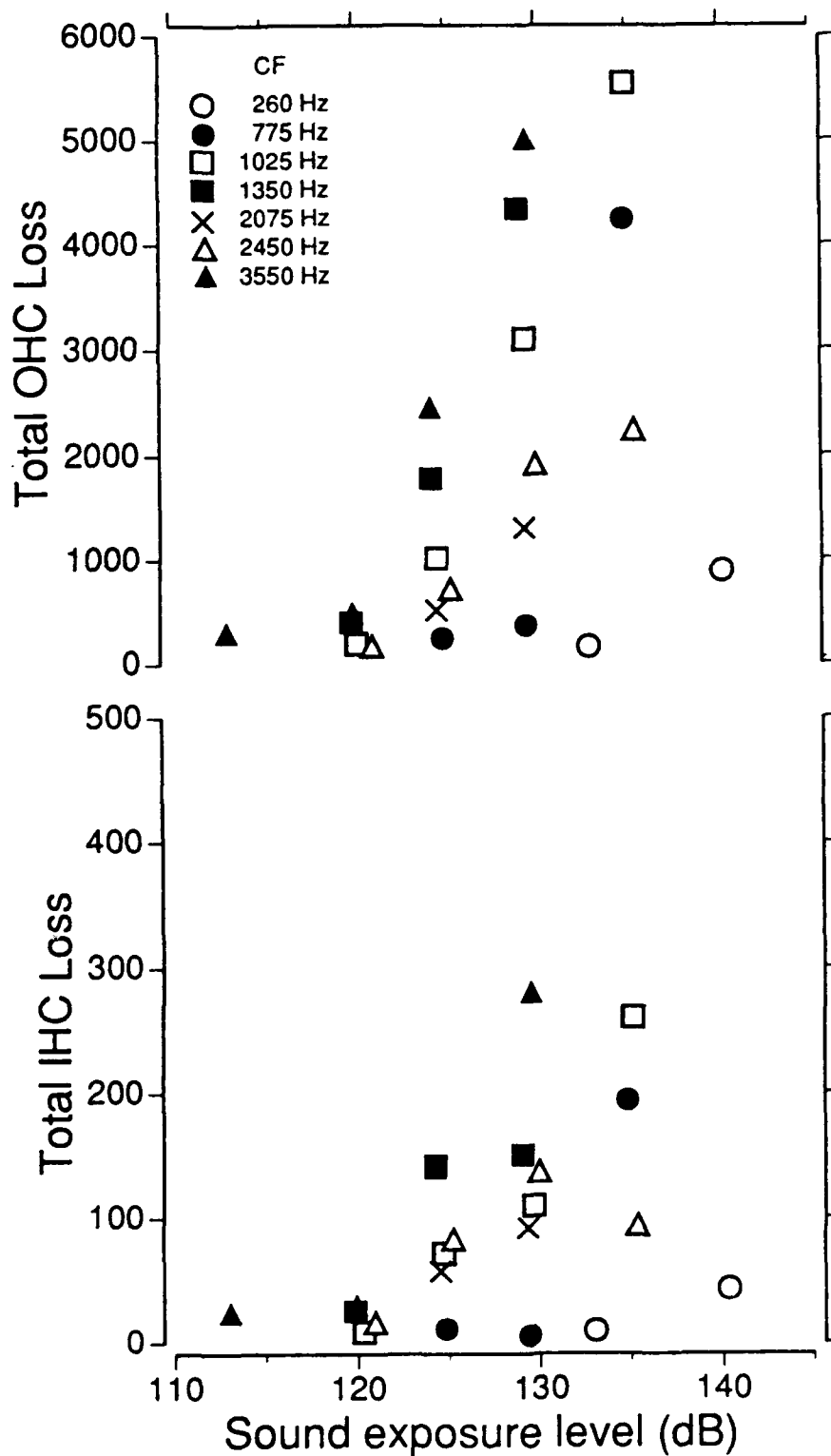


Figure 20. The group mean total outer (upper) and inner (lower) hair cell loss as a function of the total sound exposure level for 22 groups of animals exposed to various narrow band impulses.



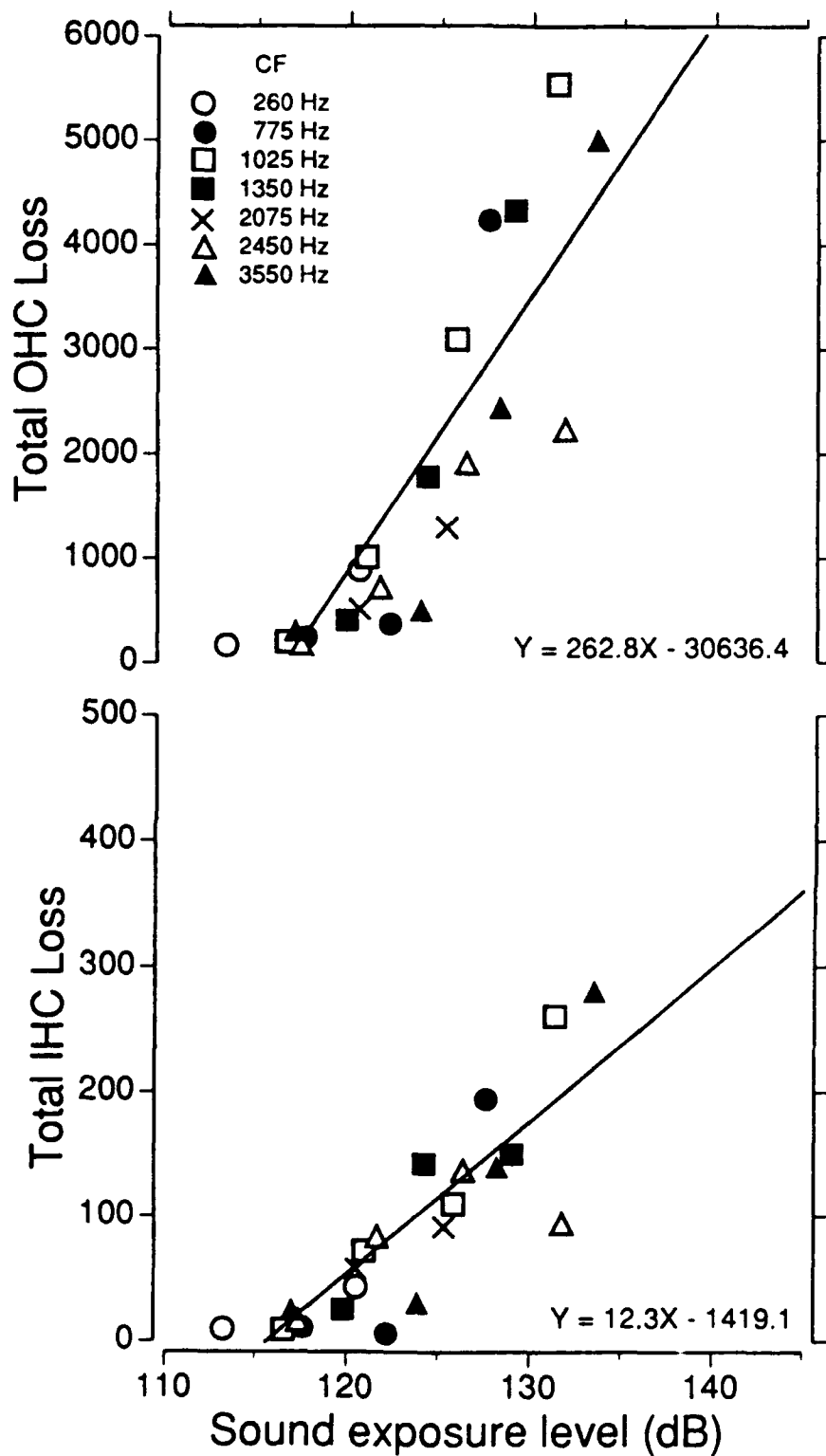


Figure 21. The group mean total outer (upper) and inner (lower) hair cell loss as a function of the P-weighted total sound level. The regression lines yield correlation coefficients of 0.849 and 0.841 for outer and inner hair cell loss respectively.

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## Appendix

Individual data and Group  
summary statistics.

## Guide to the appendix

The individual data and summary statistics for each experimental group are presented in the data appendix that follows. The following paragraphs present a brief description of the contents of the data appendix. In this summary, only a single exposure group of the appendix is described. All the remaining exposure groups are organized in the same manner.

### Group title page

The group title page indicates the exposure that each animal in this group received (e.g., 2075 Hz center frequency, 134-dB peak SPL) and the subjects that comprise this group.

### Preexposure and permanent threshold shift audiograms

The top panel depicts the mean preexposure thresholds for this group. The error bars on this figure and all others in the appendices represent one standard error of the mean plotted above and below the mean. The lower panel presents the group mean PTS measured between 20 and 30 days after exposure.

### Preexposure, postexposure, and PTS measurements

This page tabulates the pre- and postexposure thresholds (in dB SPL) for each subject as well as the group mean and standard deviation. PTS is computed by subtracting the pre-exposure threshold from the postexposure threshold for each subject.

### Temporary threshold shift

This table presents the threshold shift for each of the 10 audiometric frequencies measured immediately after exposure and at regular intervals up to 30 days postexposure.

### Total cell loss summary

The total sensory cell losses for this group are presented in the top portion of this table. The lower portion of the table presents the mean and standard deviation for the total number of inner and outer hair cells missing along octave band lengths of the cochlea.

### Total cell losses

The total sensory cell losses in octave band lengths of the cochlea for each animal that comprises the exposure group are presented in this table. Also included at the end of the table are the group mean and standard deviation for each octave band length.

### Present sensory cell losses

This table presents the percent sensory cell losses in octave band lengths of the cochlea for each animal in this group. Also, included are the means and standard deviation for each sensory cell and octave band length.

### Cochleograms and PTS audiograms

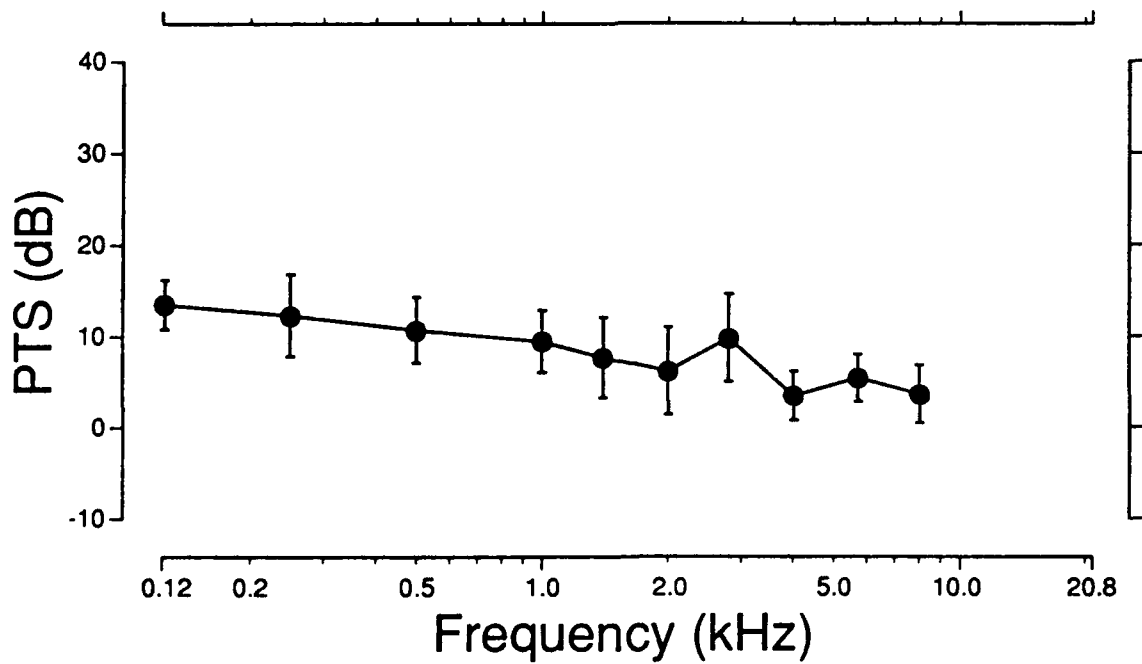
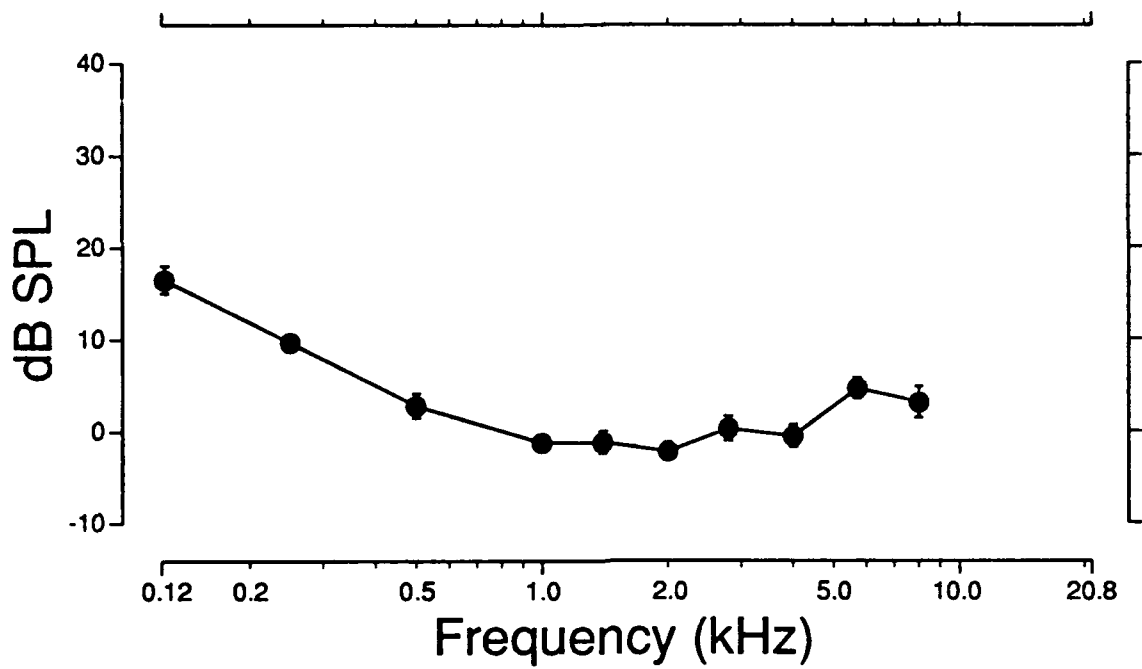
These figures present cochleograms and PTS audiograms for each animal in the exposure group. The cochleograms show the percent inner and outer hair cell losses for each 0.24 mm segment of the basilar membrane. The PTS audiogram is plotted to allow easy comparison of the PTS and cell loss resulting from the noise exposure.

Summary data for the group exposed to  
2075 Hz center frequency, 134-dB peak SPL

Animal #

S70	-	Completed the entire protocol
T71	-	Completed the entire protocol
U86	-	Completed the entire protocol
U87	-	Completed the entire protocol
U91	-	Completed the entire protocol
U100	-	Completed the entire protocol

2075 Hz center frequency, 134 dB peak SPL





2075 Hz center frequency, 134 dB Peak SPL

Preexposure thresholds (dB SPL)

Animal\kHz	.125	0.25	0.5	1.0	1.4	2.0	2.8	4.0	5.7	8.0
S70	17.5	10.5	3.5	1.5	2.5	-3.5	-4.5	-5.5	5.5	-1.5
T71	14.5	6.5	-1.5	-2.5	-1.5	-5.5	1.5	-0.5	4.5	3.5
U86	16.5	9.5	3.5	0.5	-1.5	-0.5	0.5	-1.5	4.5	1.5
U87	10.5	10.5	5.5	-3.5	-6.5	-3.5	3.5	0.5	7.5	-0.5
U91	18.5	10.5	6.5	-2.5	-0.5	0.5	-2.5	3.5	-0.5	6.5
U100	21.5	10.5	-0.5	-0.5	0.5	-0.5	3.5	0.5	6.5	9.5
Mean	16.5	9.7	2.8	-1.2	-1.2	-2.2	0.3	-0.5	4.7	3.2
S.D.	3.7	1.6	3.2	2.0	3.0	2.3	3.3	3.0	2.8	4.2

Postexposure thresholds (dB SPL)

Animal\kHz	.125	0.25	0.5	1.0	1.4	2.0	2.8	4.0	5.7	8.0
S70	38.0	25.0	11.0	12.0	7.0	-6.0	-4.0	-10.0	13.0	7.0
T71	34.0	14.0	4.0	-1.0	1.0	-3.0	8.0	2.0	6.0	6.0
U86	26.5	23.5	16.5	7.5	13.5	13.5	12.5	7.5	7.5	10.5
U87	28.0	41.0	32.0	22.0	18.0	23.0	35.0	14.0	24.0	9.0
U91	28.0	21.0	7.0	3.0	6.0	1.0	7.0	5.0	6.0	10.0
U100	25.5	7.5	10.5	6.5	-6.5	-4.5	2.5	-0.5	4.5	-1.5
Mean	30.0	22.0	13.5	8.3	6.5	4.0	10.2	3.0	10.2	6.8
S.D.	4.9	11.4	10.0	8.0	8.7	11.7	13.4	8.1	7.4	4.4

Permanent threshold shift (dB)

Animal\kHz	.125	0.25	0.5	1.0	1.4	2.0	2.8	4.0	5.7	8.0
S70	20.5	14.5	7.5	10.5	4.5	-2.5	0.5	-4.5	7.5	8.5
T71	19.5	7.5	5.5	1.5	2.5	2.5	6.5	2.5	1.5	2.5
U86	10.0	14.0	13.0	7.0	15.0	14.0	12.0	9.0	3.0	9.0
U87	17.5	30.5	26.5	25.5	24.5	26.5	31.5	13.5	16.5	9.5
U91	9.5	10.5	0.5	5.5	6.5	0.5	9.5	1.5	6.5	3.5
U100	4.0	-3.0	11.0	7.0	-7.0	-4.0	-1.0	-1.0	-2.0	-11.0
Mean	13.5	12.3	10.7	9.5	7.7	6.2	9.8	3.5	5.5	3.7
S.D.	6.6	10.9	8.9	8.4	10.9	11.8	11.7	6.6	6.4	7.8

Temporary Threshold Shift (dB): 2075 Hz center frequency, 134 dB Peak SPL

Frequency 0.125 kHz

Animal\day	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
S70	27.5	12.5	22.5	22.5	22.5	17.5	12.5	22.5	12.5	17.5	17.5	17.5	22.5	22.5	22.5	27.5
T71	22.5	22.5	22.5	22.5	27.5	17.5	17.5	22.5	17.5	22.5	22.5	22.5	17.5	17.5	17.5	27.5
U86	16.0	21.0	16.0	26.0	16.0	26.0	16.0	16.0	16.0	6.0	16.0	16.0	-4.0	6.0	16.0	26.0
U87	12.5	27.5	42.5	47.5	32.5	47.5	52.5	27.5	32.5	37.5	22.5	7.5	22.5	22.5	12.5	52.5
U91	27.5	32.5	-12.5	32.5	32.5	37.5	22.5	22.5	27.5	27.5	22.5	-22.5	17.5	2.5	27.5	37.5
U100	16.0	21.0	31.0	36.0	26.0	1.0	11.0	1.0	-14.0	6.0	1.0	11.0	1.0	6.0	1.0	36.0
Mean	20.3	22.8	20.3	31.2	26.2	24.5	22.0	18.7	15.3	19.5	17.0	8.7	12.8	12.8	16.2	34.5
S.D.	6.4	6.8	18.5	9.7	6.3	16.4	15.5	9.4	16.2	12.4	8.3	16.1	11.4	9.0	9.1	10.1

Frequency 0.250 kHz

Animal\day	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
S70	17.5	7.5	12.5	12.5	12.5	2.5	7.5	12.5	12.5	12.5	17.5	22.5	2.5	17.5	12.5	22.5
T71	17.5	12.5	12.5	22.5	12.5	12.5	12.5	17.5	12.5	12.5	12.5	12.5	2.5	12.5	-2.5	22.5
U86	18.0	18.0	23.0	33.0	18.0	33.0	23.0	18.0	18.0	-2.0	3.0	28.0	3.0	13.0	23.0	33.0
U87	32.5	12.5	27.5	42.5	37.5	27.5	32.5	42.5	62.5	-2.5	32.5	32.5	12.5	42.5	32.5	62.5
U91	27.5	32.5	32.5	12.5	17.5	17.5	27.5	22.5	12.5	17.5	12.5	12.5	12.5	7.5	7.5	32.5
U100	27.0	27.0	42.0	47.0	27.0	17.0	17.0	7.0	2.0	2.0	2.0	2.0	2.0	-8.0	-13.0	47.0
Mean	23.3	18.3	25.0	28.3	20.8	18.3	20.0	20.0	20.0	6.7	13.3	18.3	5.8	14.2	10.0	36.7
S.D.	6.5	9.6	11.6	14.9	9.7	10.8	9.4	12.2	21.5	8.6	11.1	11.4	5.2	16.5	16.6	15.5

Frequency 0.500 kHz

Animal\day	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
S70	12.5	7.5	7.5	7.5	12.5	2.5	12.5	12.5	-7.5	7.5	2.5	7.5	7.5	7.5	12.5	12.5
T71	12.5	12.5	7.5	7.5	12.5	7.5	7.5	7.5	2.5	2.5	12.5	2.5	2.5	7.5	2.5	12.5
U86	9.0	14.0	14.0	19.0	14.0	24.0	14.0	-1.0	44.0	-16.0	14.0	29.0	-1.0	4.0	19.0	44.0
U87	27.5	12.5	-7.5	57.5	32.5	27.5	42.5	-2.5	37.5	12.5	22.5	27.5	27.5	12.5	42.5	57.5
U91	12.5	7.5	12.5	12.5	12.5	22.5	12.5	-2.5	2.5	-7.5	-7.5	2.5	2.5	2.5	2.5	22.5
U100	33.0	33.0	38.0	38.0	13.0	28.0	3.0	13.0	13.0	3.0	8.0	13.0	8.0	13.0	13.0	38.0
Mean	17.8	14.5	12.0	23.7	16.2	18.7	15.3	4.5	15.3	0.3	8.7	13.7	7.8	7.8	15.3	31.2
S.D.	9.9	9.5	14.8	20.1	8.0	10.9	13.9	7.4	20.8	10.4	10.3	12.0	10.2	4.3	14.8	18.3

Temporary Threshold Shift (dB): 2075 Hz center frequency, 134 dB Peak SPL

Frequency 1.000 kHz

Animal\day	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
S70	7.5	7.5	2.5	2.5	-2.5	-2.5	12.5	7.5	-2.5	-7.5	2.5	12.5	12.5	12.5	12.5	12.5
T71	-2.5	7.5	-7.5	-7.5	7.5	-7.5	2.5	-2.5	-2.5	12.5	2.5	2.5	-2.5	2.5	2.5	12.5
U86	32.0	17.0	27.0	32.0	27.0	32.0	27.0	12.0	7.0	12.0	7.0	2.0	2.0	12.0	12.0	32.0
U87	27.5	32.5	7.5	32.5	57.5	12.5	47.5	32.5	17.5	7.5	12.5	32.5	12.5	32.5	37.5	57.5
U91	-7.5	12.5	7.5	12.5	17.5	-2.5	17.5	7.5	-7.5	7.5	12.5	2.5	2.5	12.5	-2.5	17.5
U100	28.0	38.0	58.0	48.0	33.0	48.0	28.0	28.0	13.0	3.0	-7.0	13.0	13.0	8.0	8.0	58.0
Mean	14.2	19.2	15.8	20.0	23.3	13.3	22.5	14.2	4.2	5.8	5.0	10.8	6.7	13.3	11.7	31.7
S.D.	17.2	13.1	23.5	21.0	21.1	22.3	15.5	13.4	9.9	7.4	7.4	11.8	6.8	10.2	13.9	21.4

Frequency 1.400 kHz

Animal\day	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
S70	2.5	7.5	12.5	-12.5	2.5	-2.5	7.5	12.5	-7.5	2.5	7.5	-7.5	2.5	7.5	12.5	12.5
T71	-2.5	2.5	-7.5	-7.5	7.5	-2.5	7.5	2.5	2.5	-7.5	12.5	-7.5	2.5	2.5	2.5	12.5
U86	39.0	44.0	49.0	14.0	44.0	29.0	39.0	24.0	34.0	29.0	14.0	14.0	9.0	24.0	14.0	49.0
U87	32.5	32.5	42.5	27.5	12.5	27.5	37.5	42.5	47.5	47.5	-7.5	57.5	27.5	32.5	12.5	57.5
U91	37.5	7.5	22.5	17.5	-7.5	22.5	27.5	17.5	2.5	7.5	12.5	2.5	-2.5	7.5	12.5	37.5
U100	22.0	22.0	47.0	52.0	27.0	2.0	27.0	12.0	2.0	-13.0	-8.0	-13.0	-3.0	-8.0	-3.0	52.0
Mean	21.8	19.3	27.7	15.2	14.3	12.7	24.3	18.5	13.5	11.0	5.2	7.7	6.0	11.0	8.5	36.8
S.D.	18.0	16.4	22.5	23.6	18.5	15.2	13.9	13.7	21.9	23.1	10.2	26.2	11.4	14.8	7.0	19.9

Frequency 2.000 kHz

Animal\day	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
S70	-2.5	12.5	-2.5	2.5	-7.5	-7.5	2.5	-2.5	-2.5	-2.5	-2.5	-7.5	2.5	2.5	-7.5	12.5
T71	2.5	2.5	-2.5	2.5	-2.5	-7.5	12.5	2.5	2.5	-7.5	7.5	12.5	-7.5	2.5	-2.5	12.5
U86	23.0	3.0	43.0	33.0	48.0	38.0	28.0	18.0	23.0	8.0	23.0	13.0	3.0	8.0	23.0	48.0
U87	12.5	22.5	47.5	57.5	57.5	57.5	32.5	27.5	52.5	-12.5	32.5	22.5	7.5	32.5	37.5	57.5
U91	12.5	17.5	27.5	12.5	2.5	22.5	22.5	12.5	12.5	12.5	7.5	2.5	2.5	-7.5	-2.5	27.5
U100	13.0	28.0	63.0	48.0	33.0	18.0	18.0	13.0	-12.0	-7.0	-2.0	-7.0	-2.0	-7.0	-2.0	63.0
Mean	10.2	14.3	29.3	26.0	21.8	20.2	19.3	11.8	12.7	-1.5	11.0	6.0	1.0	5.2	7.7	36.8
S.D.	9.0	10.3	27.1	23.7	28.0	25.5	10.9	10.8	23.0	9.7	14.0	12.1	5.1	14.7	18.2	22.4

Temporary Threshold Shift (dB): 2075 Hz center frequency, 134 dB Peak SPL

Frequency 2.800 kHz

Animal\day	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
S70	2.5	-2.5	2.5	12.5	2.5	2.5	-7.5	-7.5	-7.5	-2.5	-7.5	-2.5	-2.5	17.5	-2.5	17.5
T71	12.5	12.5	12.5	12.5	12.5	2.5	2.5	7.5	7.5	17.5	7.5	7.5	2.5	7.5	7.5	17.5
U86	12.0	27.0	37.0	42.0	12.0	47.0	22.0	12.0	22.0	2.0	12.0	12.0	12.0	2.0	22.0	47.0
U87	12.5	32.5	32.5	47.5	32.5	32.5	17.5	27.5	52.5	7.5	32.5	32.5	37.5	32.5	22.5	52.5
U91	7.5	7.5	17.5	27.5	12.5	2.5	22.5	22.5	12.5	-7.5	12.5	12.5	2.5	12.5	7.5	27.5
U100	19.0	29.0	54.0	64.0	24.0	19.0	19.0	9.0	4.0	-1.0	-11.0	4.0	4.0	-1.0	-1.0	64.0
Mean	11.0	17.7	26.0	34.3	16.0	17.7	12.7	11.8	15.2	2.7	7.7	11.0	9.3	11.8	9.3	37.7
S.D.	5.5	13.9	18.7	20.6	10.6	18.8	12.3	12.3	20.7	8.8	15.7	11.9	14.6	12.2	10.8	19.6

Frequency 4.000 kHz

Animal\day	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
S70	-7.5	-2.5	-7.5	-7.5	-12.5	-12.5	-2.5	-7.5	-7.5	2.5	-7.5	-7.5	-7.5	-7.5	7.5	7.5
T71	12.5	7.5	2.5	-7.5	12.5	2.5	7.5	7.5	2.5	12.5	2.5	7.5	-2.5	2.5	2.5	12.5
U86	14.0	14.0	14.0	24.0	24.0	4.0	4.0	14.0	9.0	9.0	14.0	9.0	9.0	4.0	9.0	24.0
U87	-7.5	12.5	7.5	47.5	52.5	37.5	52.5	32.5	32.5	32.5	27.5	2.5	-2.5	17.5	22.5	52.5
U91	7.5	7.5	2.5	22.5	2.5	12.5	12.5	12.5	2.5	-2.5	2.5	2.5	12.5	-7.5	-2.5	22.5
U100	12.0	22.0	67.0	42.0	22.0	12.0	2.0	2.0	-8.0	2.0	-3.0	2.0	12.0	-8.0	-8.0	67.0
Mean	5.2	10.2	14.3	20.2	16.8	9.3	12.7	10.2	5.2	9.3	6.0	2.7	3.5	0.2	5.2	31.0
S.D.	10.0	8.2	26.7	23.6	22.1	16.5	20.2	13.5	14.9	12.5	12.8	5.8	8.7	10.0	10.6	23.6

Frequency 5.700 kHz

Animal\day	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
S70	7.5	2.5	12.5	2.5	2.5	-7.5	2.5	2.5	2.5	2.5	7.5	2.5	12.5	7.5	7.5	12.5
T71	2.5	-2.5	2.5	2.5	7.5	7.5	7.5	12.5	2.5	12.5	-2.5	2.5	2.5	7.5	-2.5	12.5
U86	8.0	18.0	8.0	13.0	3.0	43.0	18.0	13.0	38.0	3.0	23.0	-2.0	-2.0	-2.0	-2.0	43.0
U87	2.5	12.5	57.5	62.5	52.5	32.5	62.5	12.5	37.5	32.5	12.5	12.5	17.5	17.5	22.5	62.5
U91	12.5	17.5	17.5	12.5	12.5	2.5	22.5	2.5	7.5	7.5	12.5	17.5	-7.5	2.5	7.5	22.5
U100	1.0	31.0	31.0	51.0	16.0	1.0	1.0	-9.0	6.0	-4.0	1.0	1.0	-4.0	-4.0	-4.0	51.0
Mean	5.7	13.2	21.5	24.0	15.7	13.2	19.0	5.7	15.7	9.0	9.0	5.7	3.2	4.8	4.8	34.0
S.D.	4.4	12.0	20.1	26.0	18.8	19.9	23.0	8.7	17.2	12.8	9.2	7.6	9.8	7.8	10.0	21.2

Temporary Threshold Shift (dB): 2075 Hz center frequency, 134 dB Peak SPL

Animal\day	Frequency 8.000 kHz															Max
	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	
S70	7.5	7.5	2.5	2.5	2.5	12.5	7.5	7.5	2.5	12.5	12.5	2.5	12.5	2.5	12.5	12.5
T71	12.5	12.5	-2.5	-2.5	7.5	2.5	12.5	12.5	2.5	7.5	2.5	-2.5	12.5	2.5	-2.5	12.5
U86	11.0	11.0	11.0	11.0	31.0	26.0	21.0	16.0	16.0	1.0	11.0	11.0	6.0	6.0	11.0	31.0
U87	-7.5	7.5	2.5	47.5	22.5	47.5	47.5	-7.5	12.5	22.5	2.5	2.5	12.5	17.5	12.5	47.5
U91	12.5	7.5	12.5	12.5	2.5	-2.5	12.5	2.5	12.5	7.5	2.5	12.5	7.5	2.5	-7.5	12.5
U100	-2.0	3.0	48.0	38.0	3.0	3.0	-7.0	-7.0	3.0	-7.0	-17.0	-7.0	-17.0	-2.0	-12.0	48.0
Mean	5.7	8.2	12.3	18.2	11.5	14.8	15.7	4.0	8.2	7.3	2.3	3.2	5.7	4.8	2.3	27.3
S.D.	8.5	3.3	18.4	20.0	12.3	18.9	18.1	9.8	6.2	10.0	10.5	7.5	11.5	6.7	11.0	17.4

Summary of group anatomical data  
with cochleograms and PTS audiograms  
for individual animals

2075 Hz center frequency, 134 dB peak SPL

Total number of cochlear sensory cells missing

Animal number	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Total outer hair cells
S70	18	84	99	159	342
T71	5	45	61	143	249
U86	58	105	155	183	443
U87	132	418	435	321	1174
U91	58	81	95	128	304
U100	76	163	174	273	610
Group mean	58				520
S.D.	45				345
S.E.	18				141

Total sensory cell losses over octave band lengths of the cochlea centered at the frequencies indicated

Octave band center frequency	Inner hair cells	Outer hair cells
Group means		
0.125 kHz	1.7	60.7
0.25 kHz	1.5	63.2
0.5 kHz	1.5	48.2
1 kHz	37.0	195.5
2 kHz	11.7	88.2
4 kHz	2.3	22.0
8 kHz	1.2	18.7
16 kHz	1.0	24.0
Standard deviations		
0.125 kHz	1.5	26.3
0.25 kHz	1.6	24.9
0.5 kHz	2.3	28.7
1 kHz	37.3	197.5
2 kHz	16.5	128.5
4 kHz	2.0	22.4
8 kHz	1.9	14.9
16 kHz	2.0	27.7

2075 Hz center frequency, 134 dB peak SPL

Total sensory cell losses over octave band frequencies

	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Comb. outer hair cells	Inner pillar cells	Outer pillar cells
Chinchilla S70							
0.125 kHz	1	15	24	55	94	0	2
0.25 kHz	3	11	11	30	52	0	1
0.5 kHz	1	14	24	14	52	0	0
1 kHz	2	3	10	9	22	0	0
2 kHz	2	9	4	5	18	0	0
4 kHz	3	7	4	6	17	1	0
8 kHz	1	5	1	7	13	0	0
16 kHz	5	20	21	33	74	0	0
TOTALS	18	84	99	159	342	1	3

Chinchilla T71

0.125 kHz	3	8	13	39	60	2	1
0.25 kHz	0	4	4	42	50	0	0
0.5 kHz	1	20	28	35	83	0	0
1 kHz	0	3	4	7	14	0	0
2 kHz	0	3	6	10	19	0	0
4 kHz	1	2	2	4	8	0	0
8 kHz	0	3	3	4	10	0	0
16 kHz	0	2	1	2	5	0	0
TOTALS	5	45	61	143	249	2	1

Chinchilla U86

0.125 kHz	1	2	3	18	23	0	0
0.25 kHz	0	7	20	29	56	0	0
0.5 kHz	1	4	28	18	50	0	0
1 kHz	47	76	83	74	233	95	65
2 kHz	3	6	6	9	21	0	0
4 kHz	5	4	8	6	18	0	0
8 kHz	1	5	6	29	40	0	0
16 kHz	0	1	1	0	2	0	0
TOTALS	58	105	155	183	443	95	65



2075 Hz center frequency, 134 dB peak SPL

Total sensory cell losses over octave band frequencies

	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Comb. outer hair cells	Inner pillar cells	Outer pillar cells
Chinchilla U87							
0.125 kHz	1	8	13	27	48	0	1
0.25 kHz	1	8	33	47	88	0	0
0.5 kHz	0	22	30	22	74	0	1
1 kHz	87	251	145	115	511	165	105
2 kHz	42	97	159	86	342	69	57
4 kHz	1	18	43	6	67	0	0
8 kHz	0	8	10	17	35	0	0
16 kHz	0	6	2	1	9	0	0
TOTALS	132	418	435	321	1174	234	164

Chinchilla U91

0.125 kHz	4	8	20	24	52	0	0
0.25 kHz	4	4	9	21	34	0	0
0.5 kHz	6	2	2	9	13	0	0
1 kHz	14	21	19	32	72	25	15
2 kHz	20	36	35	31	102	48	29
4 kHz	4	2	4	3	9	0	0
8 kHz	5	1	0	5	6	0	0
16 kHz	1	7	6	3	16	0	0
TOTALS	58	81	95	128	304	73	44

Chinchilla U100

0.125 kHz	0	4	28	55	87	0	0
0.25 kHz	1	10	14	75	99	0	0
0.5 kHz	0	5	2	10	17	0	1
1 kHz	72	113	105	103	321	155	101
2 kHz	3	13	8	6	27	4	8
4 kHz	0	4	3	6	13	0	0
8 kHz	0	3	2	3	8	0	0
16 kHz	0	11	12	15	38	0	0
TOTALS	76	163	174	273	610	159	110

2075 Hz center frequency, 134 dB peak SPL

Total sensory cell losses over octave band frequencies

	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Comb. outer hair cells	Inner pillar cells	Outer pillar cells
Group means							
0.125 kHz	1.7	7.5	16.8	36.3	60.7	0.3	0.7
0.25 kHz	1.5	7.3	15.2	40.7	63.2	0.0	0.2
0.5 kHz	1.5	11.2	19.0	18.0	48.2	0.0	0.3
1 kHz	37.0	77.8	61.0	56.7	195.5	73.3	47.7
2 kHz	11.7	27.3	36.3	24.5	88.2	20.2	15.7
4 kHz	2.3	6.2	10.7	5.2	22.0	0.2	0.0
8 kHz	1.2	4.2	3.7	10.8	18.7	0.0	0.0
16 kHz	1.0	7.8	7.2	9.0	24.0	0.0	0.0
TOTALS	57.8	149.3	169.8	201.2	520.3	94.0	64.5

Group standard deviations

0.125 kHz	1.5	4.5	9.0	16.0	26.3	0.8	0.8
0.25 kHz	1.6	2.9	10.2	19.3	24.9	0.0	0.4
0.5 kHz	2.3	8.7	13.3	9.7	28.7	0.0	0.5
1 kHz	37.3	95.6	58.5	47.3	197.5	75.7	49.1
2 kHz	16.5	36.1	61.2	31.6	128.5	30.5	23.2
4 kHz	2.0	6.1	16.0	1.3	22.4	0.4	0.0
8 kHz	1.9	2.4	3.7	10.2	14.9	0.0	0.0
16 kHz	2.0	7.0	8.0	13.0	27.7	0.0	0.0
TOTALS	45.2	137.2	136.4	77.9	344.5	91.0	63.6

2075 Hz center frequency, 134 dB peak SPL

Percent sensory cell losses over octave band frequencies

	Inner hair cells	1st row outer cells	2nd row outer cells	3rd row outer cells	Comb. outer cells	Inner pillar cells	Outer pillar cells
Chinchilla S70							
0.125 kHz	0.7	7.6	12.2	27.9	15.9	0.0	1.0
0.25 kHz	1.1	3.2	3.2	8.7	5.0	0.0	0.3
0.5 kHz	0.4	4.1	7.0	4.1	5.1	0.0	0.0
1 kHz	0.8	0.9	3.0	2.7	2.2	0.0	0.0
2 kHz	0.8	2.7	1.2	1.5	1.8	0.0	0.0
4 kHz	1.1	2.1	1.2	1.8	1.7	0.2	0.0
8 kHz	0.4	1.5	0.3	2.1	1.3	0.0	0.0
16 kHz	2.1	6.7	7.0	11.0	8.2	0.0	0.0
Chinchilla T71							
0.125 kHz	2.2	4.4	7.2	21.7	11.1	0.7	0.6
0.25 kHz	0.0	1.3	1.3	13.3	5.3	0.0	0.0
0.5 kHz	0.4	6.3	8.9	11.1	8.8	0.0	0.0
1 kHz	0.0	1.0	1.3	2.3	1.5	0.0	0.0
2 kHz	0.0	1.0	2.0	3.3	2.1	0.0	0.0
4 kHz	0.4	0.7	0.7	1.3	0.9	0.0	0.0
8 kHz	0.0	1.0	1.0	1.3	1.1	0.0	0.0
16 kHz	0.0	0.7	0.4	0.7	0.6	0.0	0.0
Chinchilla U86							
0.125 kHz	0.7	1.1	1.6	9.7	4.1	0.0	0.0
0.25 kHz	0.0	2.1	6.1	8.9	5.7	0.0	0.0
0.5 kHz	0.4	1.2	8.6	5.5	5.1	0.0	0.0
1 kHz	19.6	24.5	26.8	23.9	25.1	19.0	21.0
2 kHz	1.3	1.9	1.9	2.8	2.2	0.0	0.0
4 kHz	2.0	1.3	2.5	1.9	1.9	0.0	0.0
8 kHz	0.4	1.6	1.9	9.1	4.2	0.0	0.0
16 kHz	0.0	0.4	0.4	0.0	0.3	0.0	0.0

2075 Hz center frequency, 134 dB peak SPL

Percent sensory cell losses over octave band frequencies

	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Comb. outer hair cells	Inner pillar cells	Outer pillar cells
Chinchilla U87							
0.125 kHz	0.7	4.5	7.3	15.2	9.0	0.0	0.6
0.25 kHz	0.4	2.6	10.6	15.1	9.4	0.0	0.0
0.5 kHz	0.0	7.1	9.6	7.1	7.9	0.0	0.3
1 kHz	38.0	84.8	49.0	38.9	57.6	34.5	35.5
2 kHz	18.5	32.0	52.5	28.4	37.6	14.1	18.8
4 kHz	0.4	6.0	14.2	2.0	7.4	0.0	0.0
8 kHz	0.0	2.6	3.3	5.6	3.8	0.0	0.0
16 kHz	0.0	2.2	0.7	0.4	1.1	0.0	0.0

Chinchilla U91							
0.125 kHz	2.9	4.3	10.8	13.0	9.4	0.0	0.0
0.25 kHz	1.6	1.2	2.8	6.5	3.5	0.0	0.0
0.5 kHz	2.5	0.6	0.6	2.8	1.3	0.0	0.0
1 kHz	5.9	6.8	6.2	10.4	7.8	5.0	4.9
2 kHz	8.5	11.4	11.1	9.8	10.8	9.4	9.2
4 kHz	1.6	0.6	1.3	1.0	1.0	0.0	0.0
8 kHz	2.0	0.3	0.0	1.6	0.6	0.0	0.0
16 kHz	0.4	2.5	2.1	1.1	1.9	0.0	0.0

Chinchilla U100							
0.125 kHz	0.0	2.2	15.3	30.1	15.9	0.0	0.0
0.25 kHz	0.4	3.1	4.4	23.4	10.3	0.0	0.0
0.5 kHz	0.0	1.6	0.6	3.1	1.8	0.0	0.3
1 kHz	30.4	37.0	34.4	33.8	35.1	31.5	33.1
2 kHz	1.3	4.2	2.6	1.9	2.9	0.8	2.6
4 kHz	0.0	1.3	1.0	1.9	1.4	0.0	0.0
8 kHz	0.0	1.0	0.6	1.0	0.9	0.0	0.0
16 kHz	0.0	4.0	4.3	5.4	4.6	0.0	0.0

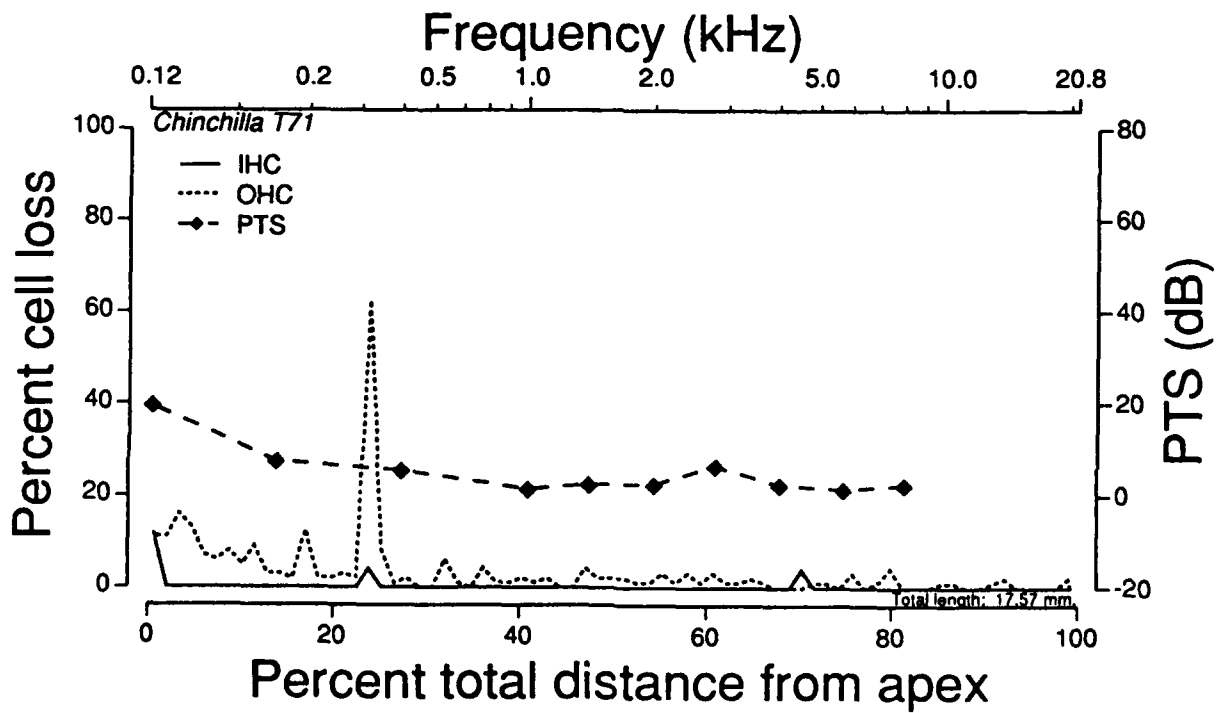
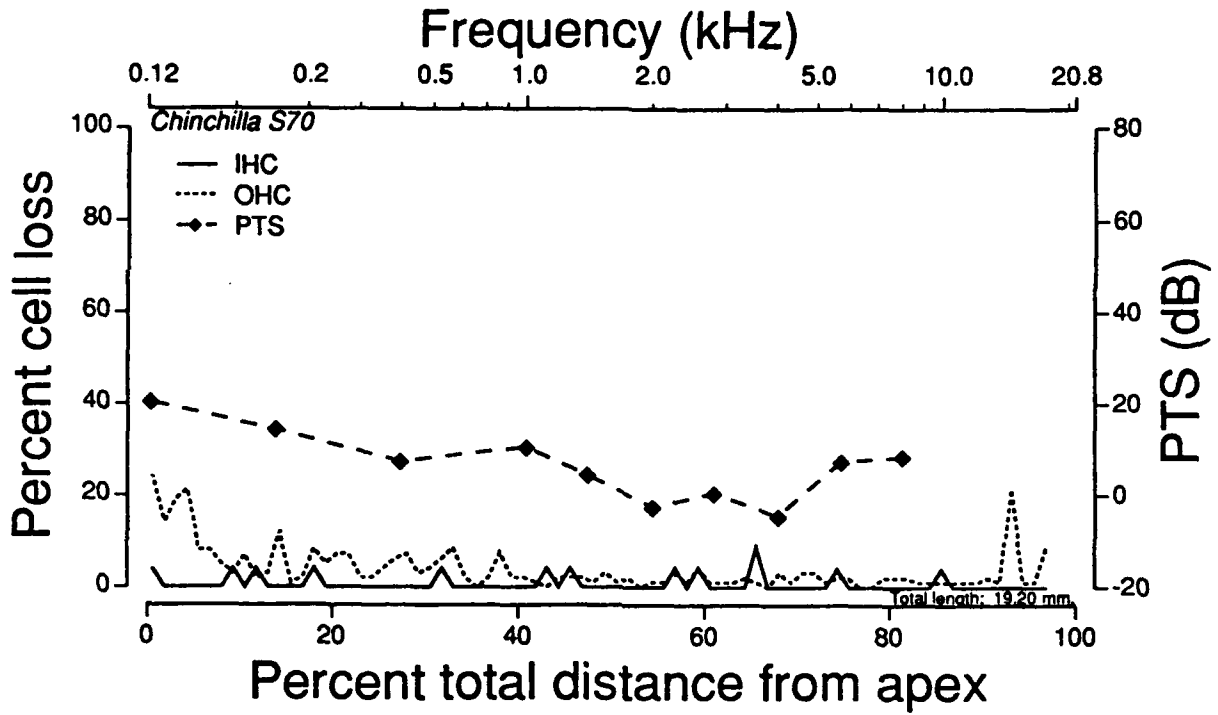
2075 Hz center frequency, 134 dB peak SPL

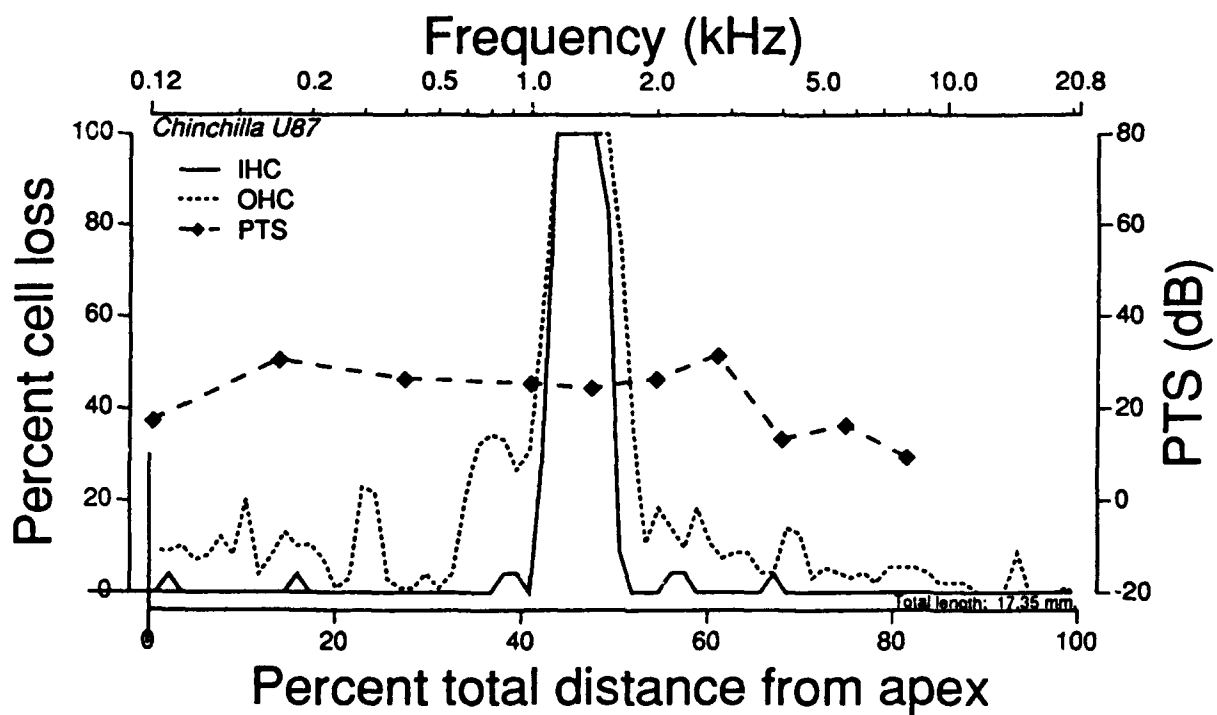
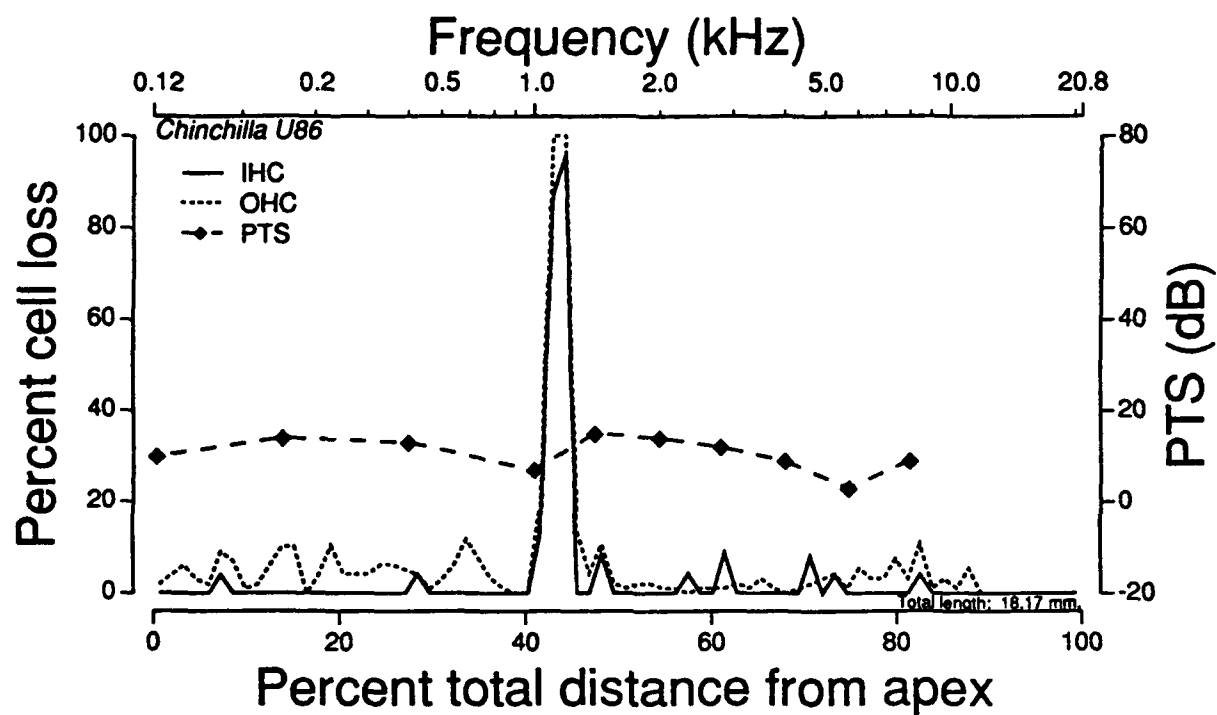
Percent sensory cell losses over octave band frequencies

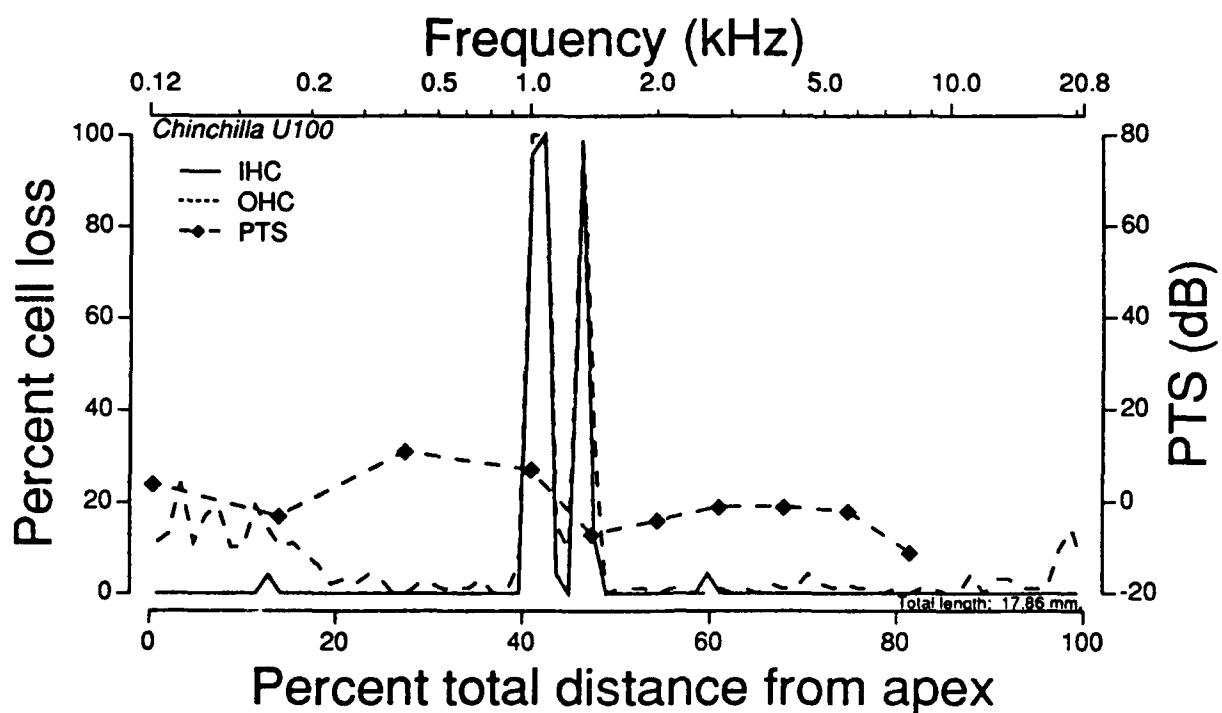
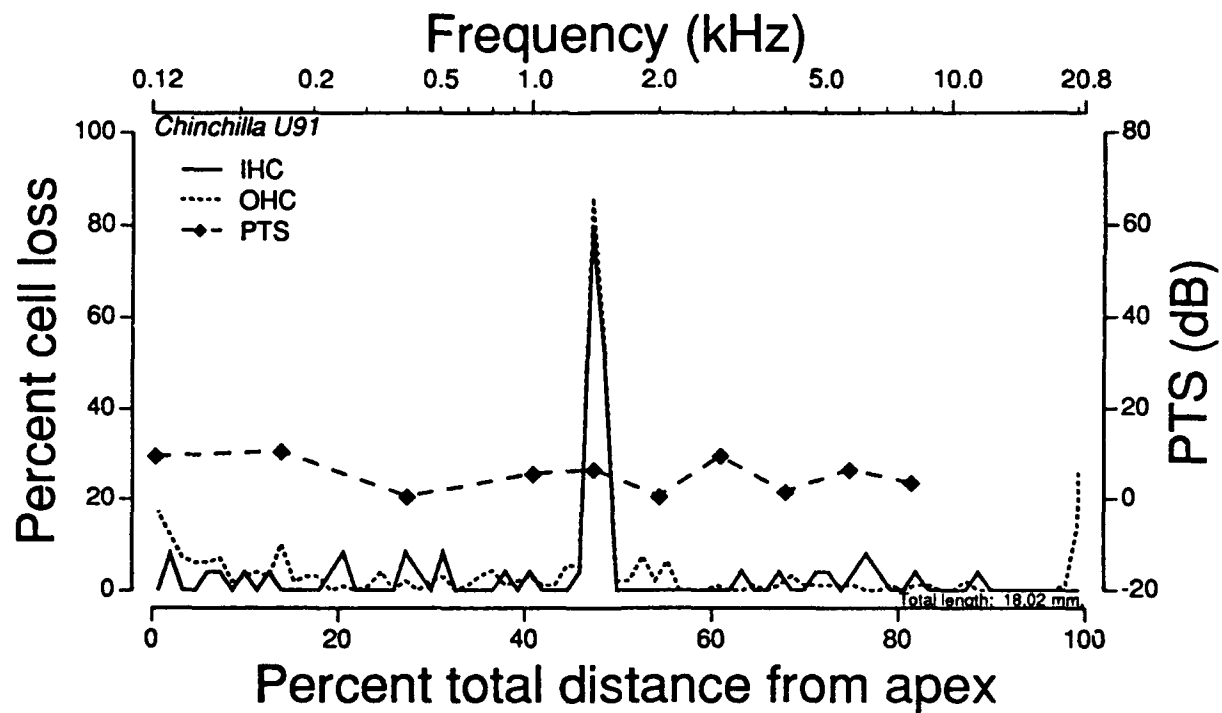
	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Comb. outer hair cells	Inner pillar cells	Outer pillar cells
Group means							
0.125 kHz	1.20	4.02	9.07	19.60	10.89	0.12	0.37
0.25 kHz	0.58	2.25	4.73	12.65	6.54	0.00	0.05
0.5 kHz	0.62	3.48	5.88	5.62	4.99	0.00	0.10
1 kHz	15.78	25.83	20.12	18.67	21.54	15.00	15.75
2 kHz	5.07	8.87	11.88	7.95	9.57	4.05	5.10
4 kHz	0.92	2.00	3.48	1.65	2.38	0.03	0.00
8 kHz	0.47	1.33	1.18	3.45	1.99	0.00	0.00
16 kHz	0.42	2.75	2.48	3.10	2.78	0.00	0.00

Group standard deviations

0.125 kHz	1.10	2.24	4.78	8.30	4.50	0.29	0.43
0.25 kHz	0.64	0.87	3.29	6.16	2.69	0.00	0.12
0.5 kHz	0.94	2.77	4.18	3.13	3.06	0.00	0.15
1 kHz	16.08	32.26	19.61	15.86	22.16	15.61	16.32
2 kHz	7.27	11.93	20.24	10.47	14.17	6.15	7.60
4 kHz	0.78	2.03	5.29	0.40	2.49	0.08	0.00
8 kHz	0.78	0.77	1.23	3.24	1.59	0.00	0.00
16 kHz	0.84	2.33	2.67	4.34	3.09	0.00	0.00







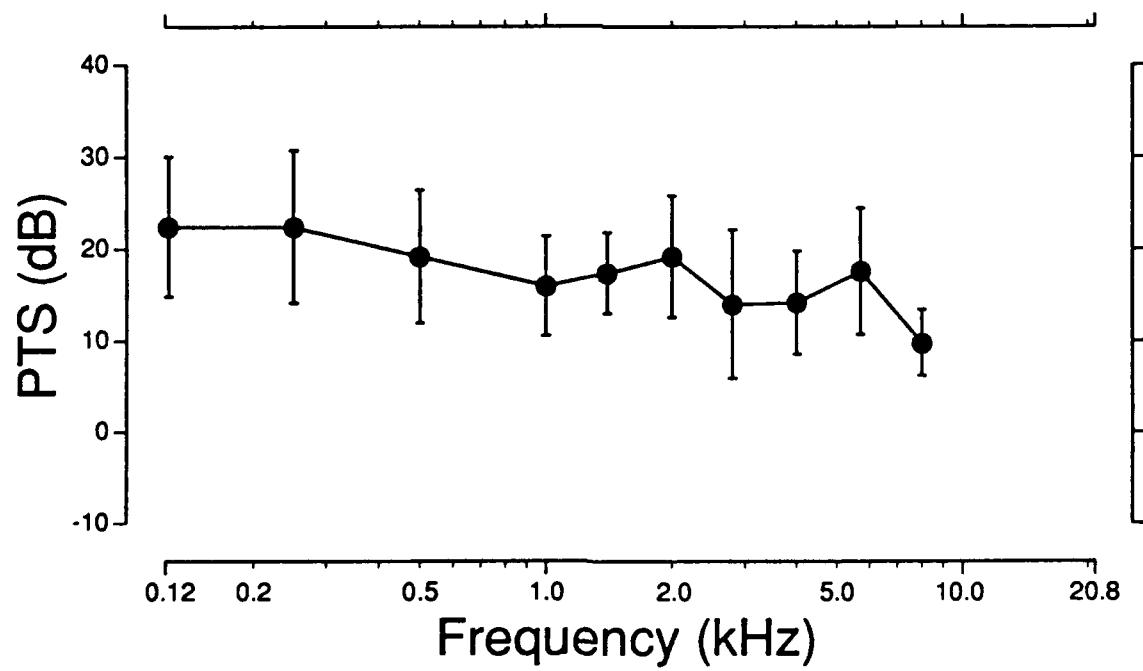
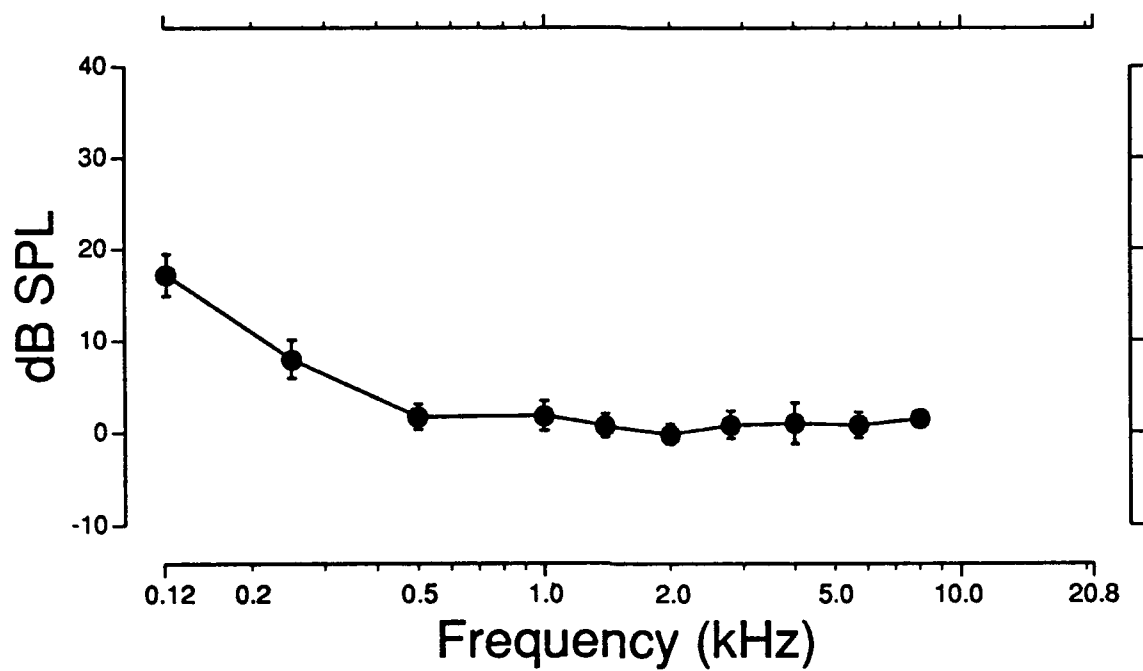


Summary data for the group exposed to  
2075 Hz center frequency, 139-dB peak SPL

Animal #

U92	-	Completed the entire protocol
U108	-	Completed the entire protocol
U112	-	Completed the entire protocol
U113	-	Completed the entire protocol
U178	-	Completed the entire protocol
U181	-	Completed the entire protocol

2075 Hz center frequency, 139 dB peak SPL



2075 Hz center frequency, 139 dB Peak SPL

Preexposure thresholds (dB SPL)

Animal\kHz	.125	.25	0.5	1.0	1.4	2.0	2.8	4.0	5.7	8.0
U92	18.5	4.5	0.5	-1.5	-0.5	-1.5	1.5	-2.5	1.5	3.5
U108	23.5	11.5	1.5	7.5	5.5	3.5	0.5	10.5	6.5	2.5
U112	19.5	-0.5	3.5	-0.5	-2.5	-4.5	7.5	1.5	-3.5	-1.5
U113	6.5	12.5	-0.5	5.5	3.5	1.5	-1.5	-1.5	-1.5	1.5
U178	17.5	8.5	7.5	-1.5	0.5	0.5	-2.5	2.5	0.5	2.5
U181	17.5	11.5	-2.5	1.5	-2.5	-0.5	-0.5	-4.5	1.5	0.5
Mean	17.2	8.0	1.7	1.8	0.7	-0.2	0.8	1.0	0.8	1.5
S.D.	5.7	5.1	3.5	3.8	3.3	2.7	3.6	5.3	3.4	1.8

Postexposure thresholds (dB SPL)

Animal\kHz	.125	.25	0.5	1.0	1.4	2.0	2.8	4.0	5.7	8.0
U92	24.5	16.5	14.5	8.5	17.5	22.5	13.5	12.5	6.5	9.5
U108	75.0	70.0	49.0	47.0	41.0	47.0	49.0	42.0	51.0	28.0
U112	47.0	11.0	27.0	9.0	7.0	15.0	16.0	23.0	20.0	5.0
U113	14.0	30.0	7.0	16.0	16.0	7.0	-2.0	-4.0	10.0	5.0
U178	37.0	24.0	11.0	11.0	11.0	4.0	1.0	6.0	6.0	9.0
U181	42.0	21.0	17.0	23.0	16.0	20.0	31.0	19.0	19.0	19.0
Mean	39.9	28.8	20.9	19.1	18.1	19.3	18.1	16.4	18.8	12.6
S.D.	21.0	21.2	15.3	14.7	11.9	15.4	19.2	15.8	16.9	9.1

Permanent threshold shift (dB)

Animal\kHz	.125	.25	0.5	1.0	1.4	2.0	2.8	4.0	5.7	8.0
U92	6.0	9.0	14.0	8.0	19.0	24.0	10.0	17.0	3.0	7.0
U108	51.5	58.5	47.5	39.5	35.5	43.5	48.5	31.5	44.5	25.5
U112	27.5	11.5	23.5	9.5	9.5	19.5	8.5	21.5	23.5	6.5
U113	7.5	17.5	7.5	10.5	12.5	5.5	-0.5	-2.5	11.5	3.5
U178	19.5	15.5	3.5	12.5	10.5	3.5	3.5	3.5	5.5	6.5
U181	24.5	9.5	19.5	21.5	18.5	20.5	31.5	23.5	17.5	18.5
Mean	22.4	22.4	19.2	16.0	17.4	19.2	14.0	14.2	17.6	9.8
S.D.	18.5	20.5	17.5	13.2	10.8	16.2	19.7	13.7	17.0	8.9

Temporary Threshold Shift (dB): 2075 Hz center frequency, 139 dB Peak SPL

Frequency 0.125 kHz

Animal\day	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
U92	2.5	47.5	22.5	37.5	27.5	22.5	22.5	17.5	22.5	37.5	27.5	22.5	17.5	22.5	32.5	47.5
U108	27.5	57.5	22.5	32.5	57.5	77.5	67.5	82.5	42.5	27.5	57.5	62.5	27.5	42.5	67.5	82.5
U112	42.5	42.5	42.5	47.5	47.5	22.5	22.5	27.5	27.5	17.5	17.5	37.5	22.5	27.5	32.5	47.5
U113	32.5	37.5	32.5	27.5	12.5	22.5	27.5	17.5	22.5	32.5	7.5	12.5	-7.5	12.5	12.5	37.5
U178	32.5	42.5	42.5	42.5	27.5	32.5	47.5	17.5	17.5	37.5	22.5	12.5	22.5	27.5	12.5	47.5
U181	47.5	67.5	27.5	42.5	27.5	22.5	17.5	37.5	32.5	32.5	22.5	32.5	27.5	2.5	37.5	67.5
Mean	30.8	49.2	31.7	38.3	33.3	33.3	34.2	33.3	27.5	30.8	25.8	30.0	18.3	22.5	32.5	55.0
S.D.	15.7	11.3	9.2	7.4	16.3	22.0	19.4	25.4	8.9	7.5	16.9	18.9	13.2	13.8	20.2	16.7

Frequency 0.250 kHz

Animal\day	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
U92	57.5	27.5	22.5	32.5	27.5	7.5	12.5	22.5	12.5	12.5	12.5	12.5	32.5	12.5	12.5	57.5
U108	62.5	32.5	57.5	62.5	67.5	57.5	52.5	62.5	7.5	32.5	57.5	62.5	47.5	67.5	57.5	67.5
U112	47.5	47.5	37.5	42.5	47.5	17.5	32.5	42.5	12.5	12.5	12.5	7.5	7.5	17.5	12.5	47.5
U113	32.5	27.5	22.5	37.5	22.5	12.5	12.5	22.5	7.5	17.5	57.5	2.5	7.5	2.5	17.5	57.5
U178	52.5	32.5	27.5	32.5	32.5	12.5	22.5	27.5	12.5	12.5	22.5	22.5	12.5	12.5	7.5	52.5
U181	37.5	67.5	27.5	32.5	47.5	37.5	2.5	22.5	12.5	17.5	12.5	7.5	2.5	12.5	12.5	67.5
Mean	48.3	39.2	32.5	40.0	40.8	24.2	22.5	33.3	10.8	17.5	29.2	19.2	18.3	20.8	20.0	58.3
S.D.	11.6	15.7	13.4	11.7	16.6	19.4	17.9	16.3	2.6	7.7	22.3	22.3	17.7	23.4	18.6	8.0

Frequency 0.500 kHz

Animal\day	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
U92	27.5	52.5	37.5	27.5	17.5	22.5	12.5	7.5	7.5	17.5	7.5	12.5	7.5	32.5	12.5	52.5
U108	52.5	62.5	67.5	57.5	62.5	52.5	57.5	62.5	12.5	32.5	57.5	47.5	42.5	32.5	57.5	67.5
U112	7.5	42.5	32.5	37.5	42.5	2.5	17.5	7.5	17.5	12.5	12.5	17.5	27.5	42.5	17.5	42.5
U113	17.5	12.5	17.5	12.5	12.5	7.5	-7.5	2.5	12.5	17.5	47.5	2.5	-12.5	-7.5	7.5	47.5
U178	27.5	22.5	32.5	27.5	12.5	27.5	22.5	12.5	2.5	2.5	12.5	-7.5	2.5	2.5	7.5	32.5
U181	62.5	52.5	42.5	57.5	57.5	52.5	27.5	37.5	32.5	17.5	17.5	22.5	7.5	37.5	12.5	62.5
Mean	32.5	40.8	38.3	36.7	34.2	27.5	21.7	21.7	14.2	16.7	25.8	15.8	12.5	23.3	19.2	50.8
S.D.	21.0	19.4	16.6	18.0	22.9	21.4	21.3	23.5	10.3	9.7	21.1	18.9	19.5	20.6	19.1	12.9

Temporary Threshold Shift (dB): 2075 Hz center frequency, 139 dB Peak SPL

Animal\day	Frequency 1.000 kHz														Max
	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.
U92	47.5	57.5	52.5	47.5	37.5	22.5	12.5	17.5	7.5	17.5	12.5	7.5	2.5	2.5	17.5
U108	52.5	47.5	62.5	62.5	57.5	57.5	2.5	42.5	12.5	42.5	37.5	42.5	42.5	32.5	42.5
U112	27.5	37.5	12.5	42.5	52.5	12.5	7.5	7.5	12.5	12.5	-7.5	12.5	12.5	27.5	2.5
U113	27.5	7.5	12.5	17.5	17.5	17.5	7.5	12.5	-2.5	7.5	37.5	2.5	-12.5	12.5	37.5
U178	52.5	52.5	52.5	32.5	22.5	27.5	22.5	2.5	12.5	17.5	22.5	12.5	12.5	-2.5	17.5
U181	77.5	47.5	32.5	57.5	32.5	22.5	47.5	22.5	7.5	2.5	7.5	37.5	7.5	32.5	22.5
Mean	47.5	41.7	37.5	43.3	36.7	26.7	16.7	17.5	8.3	16.7	18.3	19.2	10.8	17.5	19.2
S.D.	18.7	18.0	21.7	16.6	15.9	15.9	16.6	14.1	5.8	13.9	17.7	16.6	18.1	15.5	13.3

Frequency 1.400 kHz

Animal\day	Frequency 1.400 kHz														Max
	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.
U92	52.5	62.5	52.5	42.5	27.5	37.5	12.5	37.5	32.5	32.5	12.5	12.5	22.5	12.5	27.5
U108	27.5	52.5	42.5	57.5	52.5	42.5	42.5	42.5	32.5	27.5	47.5	27.5	37.5	32.5	32.5
U112	32.5	37.5	22.5	42.5	47.5	27.5	12.5	2.5	2.5	62.5	-7.5	7.5	12.5	12.5	62.5
U113	22.5	12.5	12.5	12.5	22.5	12.5	2.5	2.5	2.5	7.5	17.5	27.5	2.5	7.5	27.5
U178	52.5	57.5	52.5	52.5	37.5	37.5	52.5	17.5	27.5	17.5	2.5	17.5	12.5	2.5	17.5
U181	52.5	57.5	47.5	52.5	12.5	32.5	62.5	37.5	2.5	7.5	27.5	-2.5	7.5	12.5	47.5
Mean	40.0	46.7	38.3	43.3	33.3	31.7	30.8	23.3	16.7	25.8	16.7	15.0	15.8	13.3	25.8
S.D.	14.1	18.8	16.9	16.3	15.3	10.7	24.8	18.3	15.6	20.7	19.3	11.7	12.5	10.2	13.7

Frequency 2.000 kHz

Animal\day	Frequency 2.000 kHz														Max
	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.
U92	27.5	52.5	47.5	47.5	42.5	42.5	22.5	37.5	22.5	32.5	2.5	22.5	27.5	27.5	32.5
U108	27.5	52.5	47.5	47.5	52.5	37.5	72.5	57.5	12.5	32.5	57.5	57.5	22.5	22.5	57.5
U112	32.5	32.5	37.5	42.5	32.5	12.5	7.5	32.5	2.5	2.5	7.5	12.5	2.5	47.5	27.5
U113	12.5	7.5	7.5	12.5	7.5	2.5	7.5	-2.5	2.5	-2.5	7.5	2.5	2.5	2.5	12.5
U178	47.5	67.5	62.5	57.5	32.5	42.5	32.5	17.5	17.5	2.5	-2.5	12.5	-2.5	2.5	7.5
U181	52.5	57.5	62.5	62.5	57.5	32.5	37.5	22.5	7.5	32.5	17.5	2.5	12.5	42.5	27.5
Mean	33.3	45.0	44.2	45.0	37.5	28.3	30.0	27.5	10.8	16.7	15.0	18.3	10.8	24.2	27.5
S.D.	14.6	21.6	20.4	17.5	17.9	16.9	24.2	20.2	8.2	17.4	21.9	20.6	12.1	19.1	17.6

Temporary Threshold Shift (dB): 2075 Hz center frequency, 139 dB Peak SPL.

		Frequency 2.800 kHz															
Animal\day		0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
U92	27.5	32.5	32.5	32.5	52.5	42.5	32.5	32.5	17.5	17.5	27.5	12.5	12.5	12.5	17.5	12.5	52.5
U108	42.5	42.5	57.5	72.5	57.5	52.5	52.5	82.5	32.5	17.5	17.5	57.5	62.5	17.5	57.5	47.5	82.5
U112	32.5	32.5	32.5	32.5	32.5	42.5	17.5	12.5	12.5	2.5	2.5	-7.5	17.5	2.5	22.5	7.5	42.5
U113	12.5	32.5	12.5	27.5	27.5	17.5	2.5	7.5	12.5	2.5	-7.5	-2.5	12.5	-12.5	-2.5	2.5	32.5
U178	57.5	57.5	52.5	62.5	52.5	52.5	32.5	37.5	17.5	12.5	12.5	12.5	-2.5	2.5	2.5	2.5	62.5
U181	42.5	62.5	27.5	47.5	47.5	32.5	22.5	12.5	37.5	-2.5	7.5	17.5	37.5	37.5	22.5	42.5	62.5
Mean	35.8	43.3	35.8	49.2	40.8	26.7	30.8	21.7	8.3	10.0	15.0	23.3	10.0	20.0	19.2	55.8	
S.D.	15.4	13.6	16.6	17.2	14.4	16.9	28.0	10.7	8.6	12.1	23.0	23.1	17.0	21.2	20.4	17.5	

Frequency 4.000 kHz

		Frequency 4.000 kHz															
Animal\day		0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
U92	17.5	32.5	42.5	27.5	27.5	12.5	7.5	12.5	12.5	7.5	2.5	7.5	12.5	12.5	2.5	27.5	42.5
U108	32.5	37.5	47.5	47.5	47.5	32.5	57.5	57.5	27.5	22.5	22.5	32.5	32.5	27.5	57.5	7.5	57.5
U112	12.5	32.5	32.5	32.5	32.5	27.5	2.5	7.5	12.5	7.5	2.5	7.5	12.5	2.5	17.5	67.5	67.5
U113	12.5	32.5	37.5	7.5	7.5	22.5	2.5	7.5	2.5	2.5	7.5	-7.5	2.5	-7.5	-2.5	2.5	37.5
U178	17.5	32.5	32.5	37.5	37.5	52.5	22.5	32.5	7.5	7.5	2.5	-2.5	-2.5	2.5	12.5	7.5	52.5
U181	37.5	32.5	17.5	42.5	42.5	17.5	47.5	22.5	17.5	52.5	22.5	42.5	12.5	12.5	22.5	27.5	52.5
Mean	21.7	33.3	35.0	32.5	32.5	27.5	23.3	23.3	13.3	16.7	10.0	13.3	11.7	8.3	18.3	23.3	51.7
S.D.	10.7	2.0	10.4	14.1	14.1	14.1	24.0	19.3	8.6	18.8	9.9	19.9	12.0	12.0	21.3	24.2	10.7

Frequency 5.700 kHz

		Frequency 5.700 kHz															
Animal\day		0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.	Max
U92	12.5	32.5	12.5	22.5	22.5	12.5	12.5	17.5	2.5	7.5	2.5	7.5	2.5	2.5	12.5	7.5	32.5
U108	12.5	42.5	42.5	42.5	42.5	27.5	12.5	7.5	17.5	12.5	12.5	42.5	42.5	42.5	67.5	27.5	67.5
U112	12.5	22.5	2.5	12.5	12.5	12.5	2.5	2.5	2.5	17.5	12.5	12.5	12.5	47.5	22.5	22.5	47.5
U113	22.5	42.5	32.5	12.5	12.5	7.5	2.5	-2.5	12.5	12.5	2.5	17.5	27.5	12.5	2.5	-2.5	42.5
U178	57.5	42.5	42.5	32.5	32.5	22.5	12.5	22.5	2.5	2.5	7.5	2.5	2.5	7.5	7.5	7.5	57.5
U181	12.5	22.5	47.5	57.5	57.5	47.5	7.5	22.5	22.5	47.5	2.5	2.5	12.5	32.5	12.5	27.5	57.5
Mean	21.7	34.2	30.0	30.0	30.0	21.7	8.3	11.7	10.0	16.7	6.7	14.2	16.7	24.2	20.8	15.0	50.8
S.D.	18.0	9.8	18.4	17.8	17.8	14.6	4.9	10.7	8.8	15.9	4.9	15.1	15.6	19.1	23.8	12.5	12.5

Temporary Threshold Shift (dB): 2015 Hz center frequency, 139 dB Peak SPL

Animal\da,	Frequency 8.000 kHz														Max
	0.	.042	.125	.25	1.	2.	6.	9.	13.	16.	20.	23.	27.	29.	30.
U92	27.5	32.5	17.5	27.5	7.5	27.5	12.5	12.5	47.5	7.5	7.5	2.5	22.5	2.5	12.5
U108	22.5	72.5	32.5	42.5	32.5	22.5	7.5	62.5	67.5	27.5	37.5	32.5	12.5	12.5	32.5
U112	22.5	12.5	22.5	27.5	12.5	2.5	12.5	2.5	27.5	2.5	12.5	7.5	2.5	7.5	2.5
U113	7.5	57.5	37.5	7.5	7.5	-2.5	12.5	-7.5	2.5	12.5	2.5	2.5	2.5	-2.5	12.5
U178	17.5	22.5	42.5	47.5	12.5	32.5	52.5	17.5	-2.5	-2.5	12.5	7.5	12.5	-2.5	2.5
U181	12.5	57.5	17.5	47.5	62.5	32.5	-7.5	32.5	7.5	7.5	57.5	-2.5	2.5	22.5	12.5
Mean	18.3	42.5	28.3	33.3	22.5	19.2	15.0	20.0	25.0	9.2	21.7	8.3	9.2	6.7	12.5
S.D.	7.4	23.5	10.7	15.6	21.7	15.4	19.9	24.8	27.9	10.3	21.3	12.4	8.2	9.7	11.0
															15.3

Summary of group anatomical data  
with cochleograms and PTS audiograms  
for individual animals



2075 Hz center frequency, 139 dB peak SPL

Total number of cochlear sensory cells missing

Animal number	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Total outer hair cells
U92	13	548	495	523	1566
U108	237	618	633	650	1901
U112	39	132	160	162	454
U113	6	37	25	52	114
U178	41	355	349	339	1043
U181	217	935	944	885	2764
Group mean	92				1307
S.D.	106				976
S.E.	43				398

Total sensory cell losses over octave band lengths of the cochlea centered at the frequencies indicated

Octave band center frequency	Inner hair cells	Outer hair cells
Group means		
0.125 kHz	1.3	59.3
0.25 kHz	1.5	41.3
0.5 kHz	0.7	47.8
1 kHz	31.2	345.3
2 kHz	51.3	552.3
4 kHz	1.5	222.3
8 kHz	4.3	32.7
16 kHz	0.3	5.8

Standard deviations

0.125 kHz	1.0	31.9
0.25 kHz	1.0	19.1
0.5 kHz	1.2	25.0
1 kHz	49.2	341.3
2 kHz	57.1	394.9
4 kHz	1.4	350.0
8 kHz	9.7	44.7
16 kHz	0.5	4.6

2075 Hz center frequency, 139 dB peak SPL

Total sensory cell losses over octave band frequencies

	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Comb. outer hair cells	Inner pillar cells	Outer pillar cells
Chinchilla U92							
0.125 kHz	1	9	17	67	93	0	2
0.25 kHz	1	19	7	45	71	0	0
0.5 kHz	1	31	5	14	50	0	0
1 kHz	2	59	48	37	144	0	0
2 kHz	2	325	323	262	910	0	9
4 kHz	3	81	72	69	222	1	5
8 kHz	2	20	19	23	62	1	4
16 kHz	1	4	4	6	14	0	0
TOTALS	13	548	495	523	1566	2	20

Chinchilla U108							
0.125 kHz	1	2	15	35	52	0	1
0.25 kHz	2	4	12	9	25	0	0
0.5 kHz	0	16	35	27	78	0	2
1 kHz	121	275	263	254	792	264	175
2 kHz	112	299	292	308	899	247	180
4 kHz	1	15	11	15	41	0	0
8 kHz	0	7	4	2	13	0	0
16 kHz	0	0	1	0	1	0	0
TOTALS	237	618	633	650	1901	511	358

Chinchilla U112							
0.125 kHz	2	6	8	20	34	0	2
0.25 kHz	1	5	4	24	33	0	0
0.5 kHz	3	8	14	13	35	0	0
1 kHz	3	15	23	14	52	12	7
2 kHz	29	51	57	45	153	71	40
4 kHz	0	43	51	43	137	0	0
8 kHz	0	2	2	2	6	0	0
16 kHz	1	2	1	1	4	0	0
TOTALS	39	132	160	162	454	83	49

2075 Hz center frequency, 139 dB peak SPL

Total sensory cell losses over octave band frequencies

	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Comb. outer hair cells	Inner pillar cells	Outer pillar cells
Chinchilla U113							
0.125 kHz	3	6	5	18	29	0	0
0.25 kHz	2	11	0	9	20	0	0
0.5 kHz	0	6	6	9	21	0	1
1 kHz	1	8	7	5	20	0	1
2 kHz	0	1	4	5	10	0	0
4 kHz	0	0	2	5	7	0	0
8 kHz	0	2	0	1	3	0	0
16 kHz	0	3	1	0	4	0	0
TOTALS	6	37	25	52	114	0	2

Chinchilla U178

0.125 kHz	1	9	25	71	105	0	1
0.25 kHz	3	1	4	47	52	0	0
0.5 kHz	0	6	2	18	26	0	1
1 kHz	3	150	129	52	331	3	4
2 kHz	32	182	185	146	513	73	47
4 kHz	2	3	4	4	11	0	0
8 kHz	0	0	0	1	1	0	0
16 kHz	0	4	0	0	4	0	0
TOTALS	41	355	349	339	1043	76	53

Chinchilla U181

0.125 kHz	0	4	12	27	43	0	2
0.25 kHz	0	3	3	41	47	0	1
0.5 kHz	0	10	8	59	77	0	0
1 kHz	57	272	265	196	733	170	97
2 kHz	133	283	281	265	829	303	174
4 kHz	3	310	327	279	916	1	0
8 kHz	24	47	47	17	111	0	0
16 kHz	0	6	1	1	8	0	0
TOTALS	217	935	944	885	2764	474	274

2075 Hz center frequency, 139 dB peak SPL

Total sensory cell losses over octave band frequencies

	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Comb. outer hair cells	Inner pillar cells	Outer pillar cells
Group means							
0.125 kHz	1.3	6.0	13.7	39.7	59.3	0.0	1.3
0.25 kHz	1.5	7.2	5.0	29.2	41.3	0.0	0.2
0.5 kHz	0.7	12.8	11.7	23.3	47.8	0.0	0.7
1 kHz	31.2	129.8	122.5	93.0	345.3	74.8	47.3
2 kHz	51.3	190.2	190.3	171.8	552.3	115.7	75.0
4 kHz	1.5	75.3	77.8	69.2	222.3	0.3	0.8
8 kHz	4.3	13.0	12.0	7.7	32.7	0.2	0.7
16 kHz	0.3	3.2	1.3	1.3	5.8	0.0	0.0
TOTALS	92.2	437.5	434.3	435.2	1307.0	191.0	126.0

Group standard deviations							
0.125 kHz	1.0	2.8	7.1	23.5	31.9	0.0	0.8
0.25 kHz	1.0	6.7	4.1	17.6	19.1	0.0	0.4
0.5 kHz	1.2	9.6	12.1	18.5	25.0	0.0	0.8
1 kHz	49.2	122.3	117.4	105.2	341.3	114.1	73.0
2 kHz	57.1	137.0	133.2	126.4	394.9	128.8	81.0
4 kHz	1.4	118.9	125.3	105.8	350.0	0.5	2.0
8 kHz	9.7	18.2	18.6	9.8	44.7	0.4	1.6
16 kHz	0.5	2.0	1.4	2.3	4.6	0.0	0.0
TOTALS	105.5	332.5	332.6	312.1	976.0	236.5	150.7

2075 Hz center frequency, 139 dB peak SPL

Percent sensory cell losses over octave band frequencies

	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Comb. outer hair cells	Inner pillar cells	Outer pillar cells
Chinchilla U92							
0.125 kHz	0.7	4.7	8.9	34.9	16.2	0.0	1.0
0.25 kHz	0.4	5.7	2.1	13.4	7.1	0.0	0.0
0.5 kHz	0.4	9.2	1.5	4.2	5.0	0.0	0.0
1 kHz	0.8	18.4	15.0	11.6	15.0	0.0	0.0
2 kHz	0.8	99.4	98.8	80.1	92.8	0.0	2.8
4 kHz	1.2	24.8	22.1	21.2	22.7	0.2	1.5
8 kHz	0.8	6.1	5.8	7.0	6.3	0.2	1.2
16 kHz	0.4	1.4	1.4	2.1	1.6	0.0	0.0

Chinchilla U108

0.125 kHz	0.7	1.1	7.9	18.5	9.2	0.0	0.5
0.25 kHz	0.8	1.2	3.6	2.7	2.5	0.0	0.0
0.5 kHz	0.0	4.8	10.6	8.2	7.9	0.0	0.6
1 kHz	49.6	87.3	83.5	80.6	83.8	51.9	55.6
2 kHz	46.5	92.6	90.4	95.4	92.8	47.5	55.7
4 kHz	0.4	4.7	3.4	4.7	4.3	0.0	0.0
8 kHz	0.0	2.2	1.2	0.6	1.3	0.0	0.0
16 kHz	0.0	0.0	0.3	0.0	0.1	0.0	0.0

Chinchilla U112

0.125 kHz	1.4	3.1	4.2	10.5	5.9	0.0	1.0
0.25 kHz	0.4	1.5	1.2	7.2	3.3	0.0	0.0
0.5 kHz	1.2	2.4	4.2	3.9	3.5	0.0	0.0
1 kHz	1.2	4.7	7.2	4.4	5.4	2.3	2.2
2 kHz	12.0	15.6	17.5	13.8	15.6	13.5	12.3
4 kHz	0.0	13.2	15.7	13.2	14.0	0.0	0.0
8 kHz	0.0	0.6	0.6	0.6	0.6	0.0	0.0
16 kHz	0.4	0.7	0.3	0.3	0.4	0.0	0.0

2075 Hz center frequency, 139 dB peak SPL

Percent sensory cell losses over octave band frequencies

	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Comb. outer hair cells	Inner pillar cells	Outer pillar cells
Chinchilla U113							
0.125 kHz	2.0	3.1	2.6	9.3	5.0	0.0	0.0
0.25 kHz	0.8	3.2	0.0	2.6	1.9	0.0	0.0
0.5 kHz	0.0	1.8	1.8	2.6	2.1	0.0	0.3
1 kHz	0.4	2.5	2.2	1.5	2.1	0.0	0.3
2 kHz	0.0	0.3	1.2	1.5	1.0	0.0	0.0
4 kHz	0.0	0.0	0.6	1.5	0.7	0.0	0.0
8 kHz	0.0	0.6	0.0	0.3	0.3	0.0	0.0
16 kHz	0.0	1.0	0.3	0.0	0.4	0.0	0.0
Chinchilla U178							
0.125 kHz	0.7	4.7	13.0	36.8	18.2	0.0	0.5
0.25 kHz	1.2	0.3	1.2	13.9	5.1	0.0	0.0
0.5 kHz	0.0	1.8	0.6	5.3	2.6	0.0	0.3
1 kHz	1.2	46.7	40.2	16.2	34.4	0.6	1.2
2 kHz	13.0	55.3	56.2	44.4	52.0	13.8	14.3
4 kHz	0.8	0.9	1.2	1.2	1.1	0.0	0.0
8 kHz	0.0	0.0	0.0	0.0	0.1	0.0	0.0
16 kHz	0.0	1.4	0.0	0.0	0.5	0.0	0.0
Chinchilla U181							
0.125 kHz	0.0	2.0	5.9	13.4	7.1	0.0	1.0
0.25 kHz	0.0	0.8	0.8	11.6	4.4	0.0	0.3
0.5 kHz	0.0	2.8	2.3	16.7	7.3	0.0	0.0
1 kHz	21.8	81.0	78.9	58.3	72.7	31.4	28.9
2 kHz	51.8	82.3	81.7	77.0	80.3	54.6	50.6
4 kHz	1.1	90.4	95.3	81.3	89.0	0.2	0.0
8 kHz	8.7	13.7	13.7	4.9	10.8	0.0	0.0
16 kHz	0.0	2.0	0.3	0.3	0.9	0.0	0.0

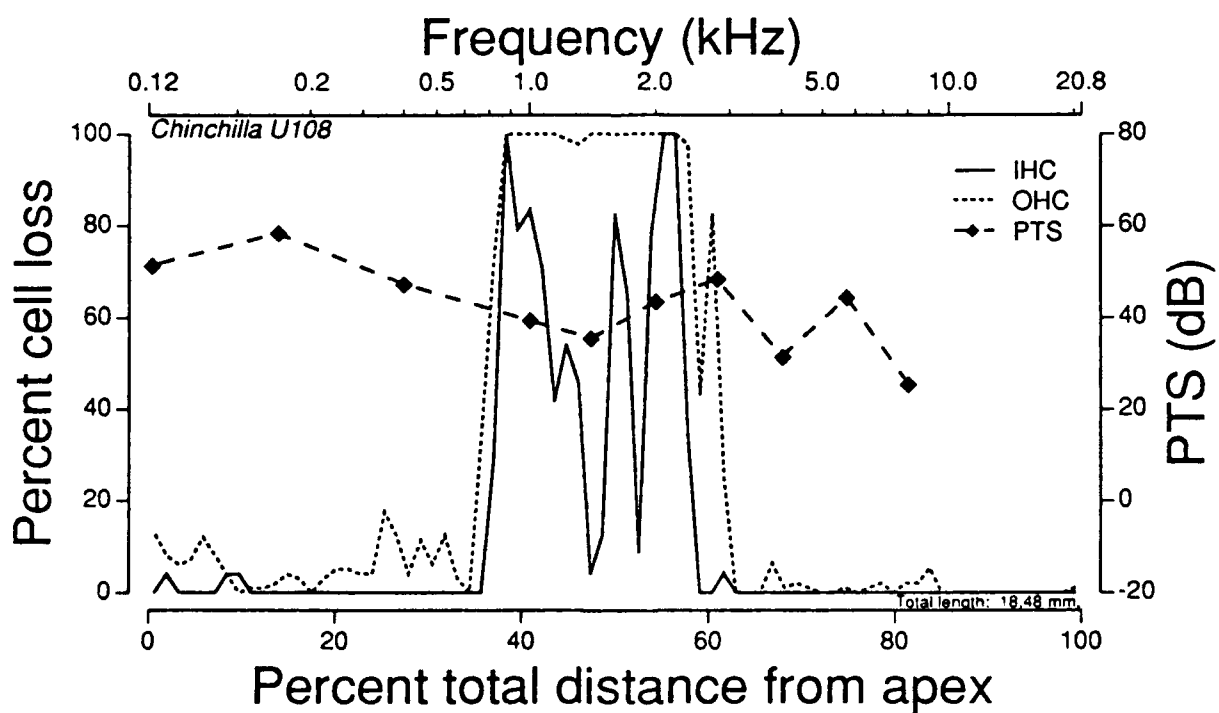
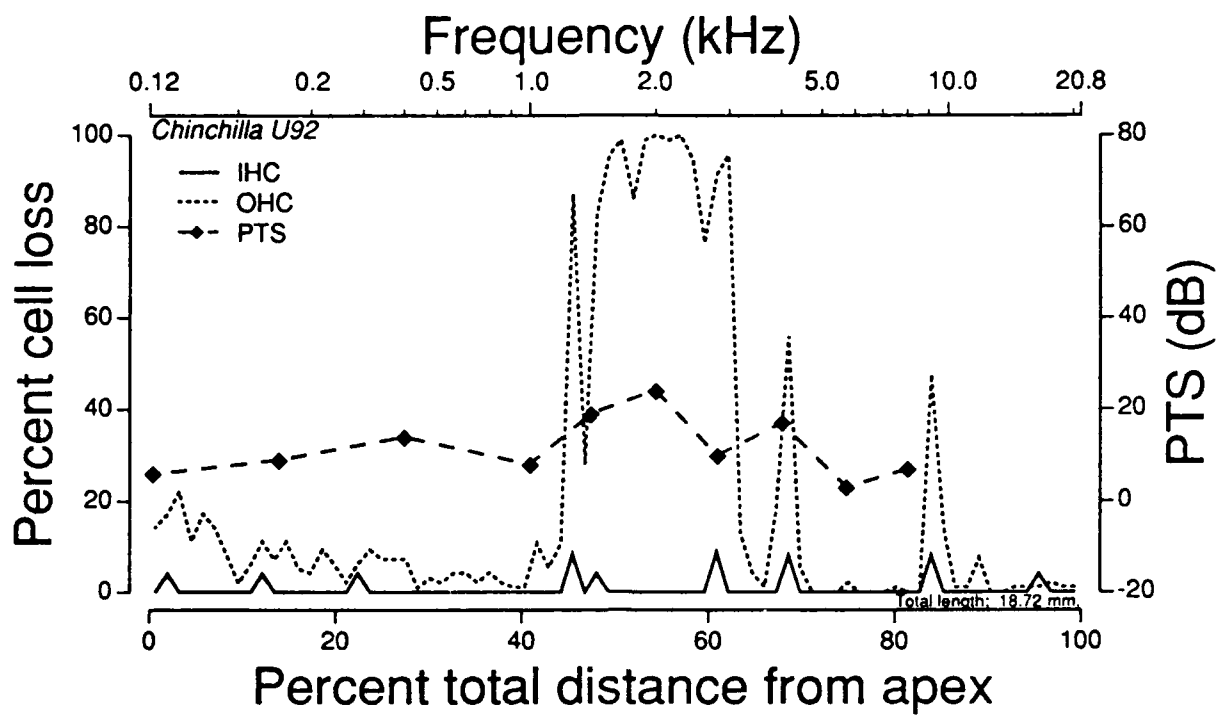
2075 Hz center frequency, 139 dB peak SPL

Percent sensory cell losses over octave band frequencies

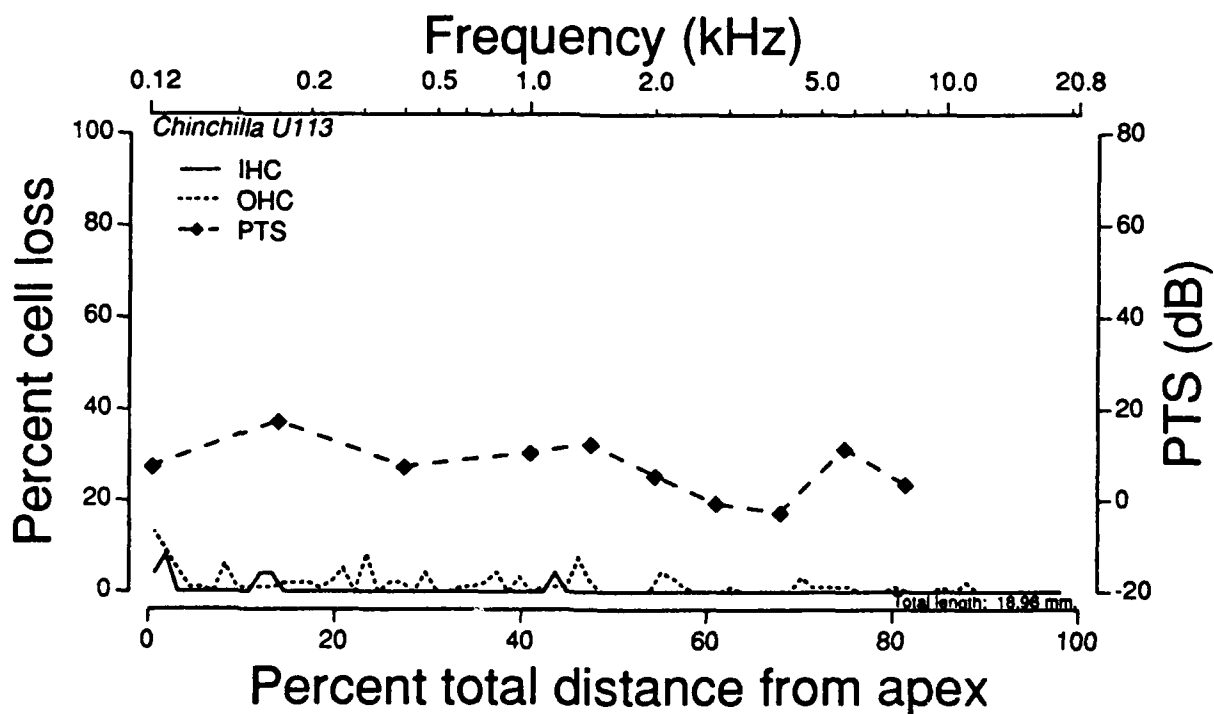
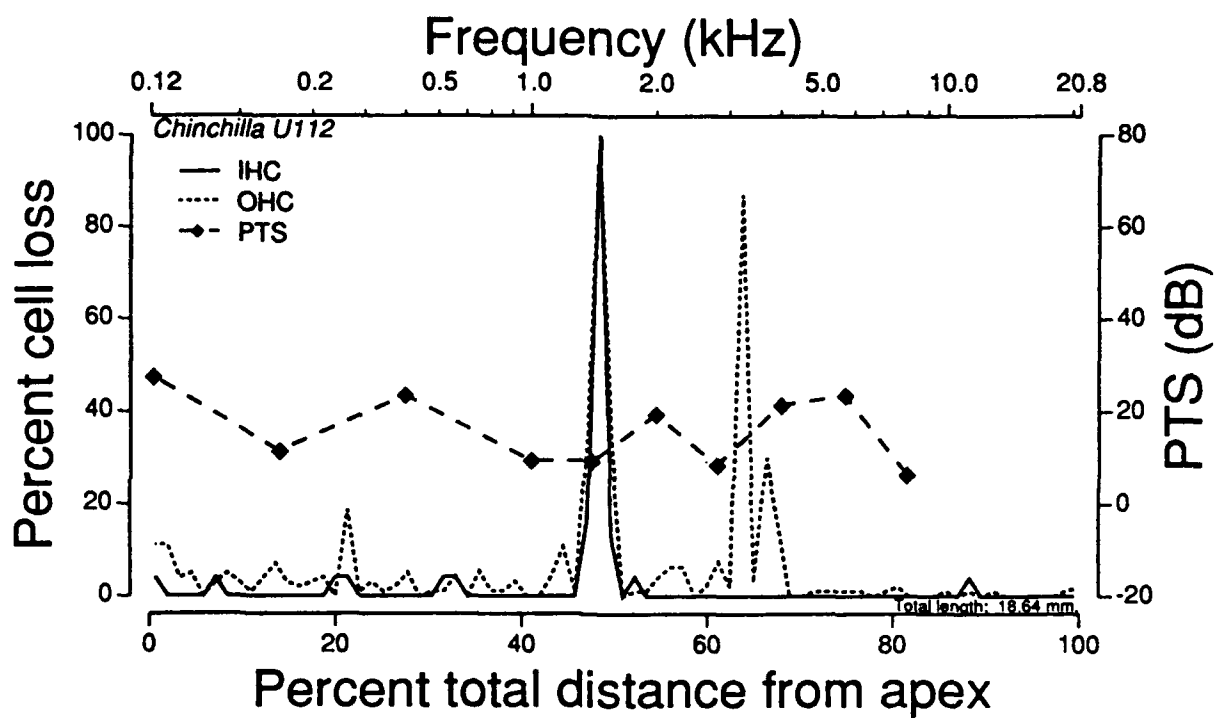
	Inner hair cells	1st row outer hair cells	2nd row outer hair cells	3rd row outer hair cells	Comb. outer hair cells	Inner pillar cells	Outer pillar cells
Group means							
0.125 kHz	0.92	3.12	7.08	20.57	10.26	0.00	0.67
0.25 kHz	0.60	2.12	1.48	8.57	4.06	0.00	0.05
0.5 kHz	0.27	3.80	3.50	6.82	4.71	0.00	0.20
1 kHz	12.50	40.10	37.83	28.77	35.57	14.37	14.70
2 kHz	20.68	57.58	57.63	52.03	55.75	21.57	22.62
4 kHz	0.58	22.33	23.05	20.52	21.97	0.07	0.25
8 kHz	1.58	3.87	3.55	2.28	3.23	0.03	0.20
16 kHz	0.13	1.08	0.43	0.45	0.66	0.00	0.00

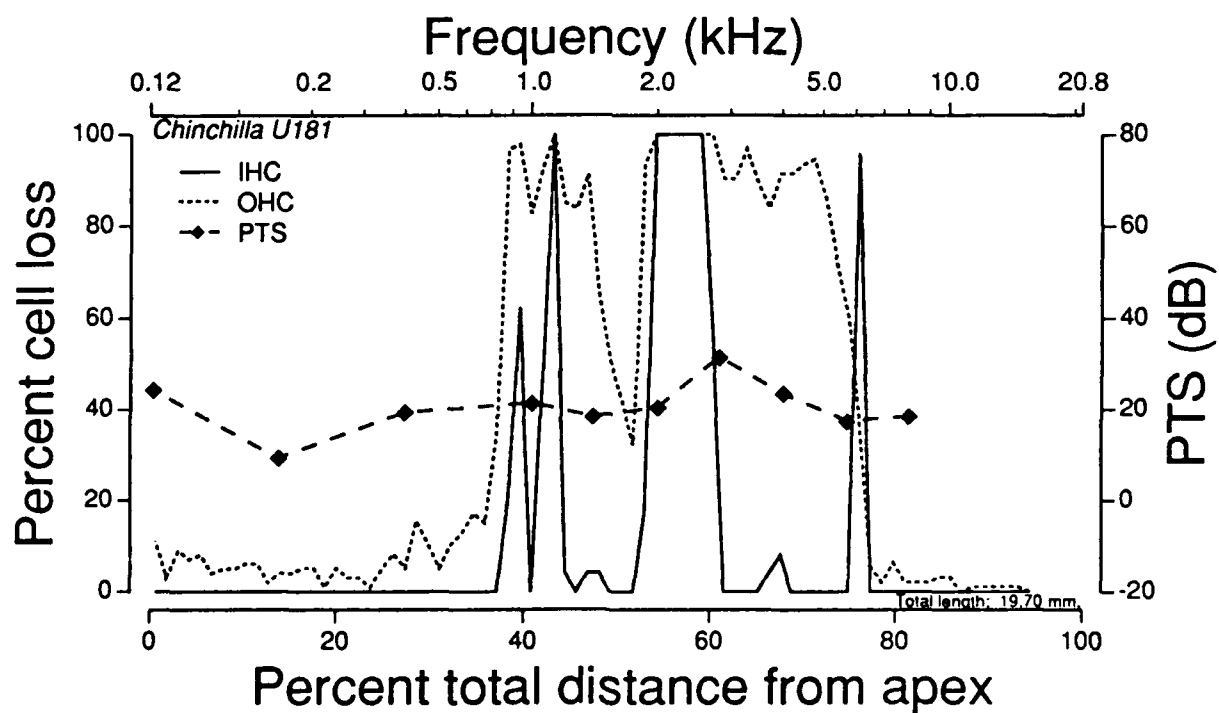
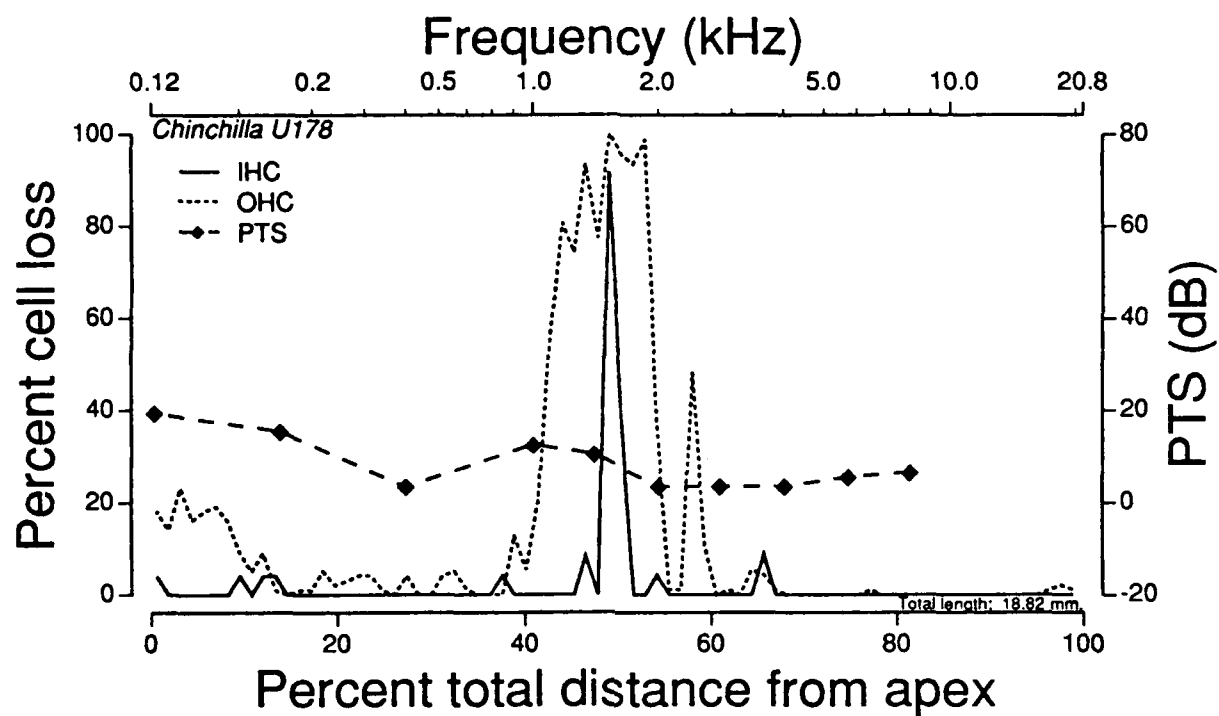
Group standard deviations

0.125 kHz	0.69	1.44	3.71	12.27	5.57	0.00	0.41
0.25 kHz	0.42	2.01	1.24	5.16	1.89	0.00	0.12
0.5 kHz	0.48	2.87	3.68	5.20	2.43	0.00	0.24
1 kHz	20.01	37.64	36.07	32.71	35.11	22.12	22.96
2 kHz	22.77	41.56	40.36	38.38	39.92	23.75	24.32
4 kHz	0.53	34.62	36.45	30.77	33.94	0.10	0.61
8 kHz	3.50	5.31	5.43	2.92	4.36	0.08	0.49
16 kHz	0.21	0.69	0.49	0.82	0.54	0.00	0.00









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